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1938

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THE JOURNAL *of the*
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CANCER OF THE MOUTH

By CHARLES B. HOPKINS,* D.M.D., Boston, Mass.

THERE are many instances in which an insignificant precancerous lesion in the mouth is overlooked when perhaps if it were recognized and given attention, it would not develop and become a tumor, to cause untold suffering and death. In the past, we have all been guilty of overlooking precancerous conditions in the mouth, in which, if the lesions are destroyed, the possibility of the patient developing cancer is remote.

CAUSES

In mouth examinations, we are confronted many times with swollen gums, ill-fitting dentures, rough as well as carious teeth, bridgework and ragged fillings, which have caused the surrounding tissues to become red, swollen and inflamed. The conditions mentioned should receive immediate attention; and it is most illogical to treat a condition without removing the cause. Many patients with mouth lesions are kept under observation without showing improvement, and when the time comes for a final analysis, cancer has developed, and it is too late to help the patient, much less cure him. If the cause of the condition is recognized and removed, the inflammation will subside. Early attention will do more to prevent the growth of cancer and save life than any treatment given after it has developed.

Cancer of the oral cavity, including tongue, floor of the mouth, cheek and mucous membranes covering the jaws, is best considered as a whole. The general treatment is, as a rule, the same. Cancer of the buccal mucous membrane is essentially of rapid growth. However, it must be borne in mind that there are many factors in the rapidity of growth. As a rule, malignant disease remains local for some time. Our object is to eliminate it before it has spread and also to rid the patient of the cause, if possible. Unfortunately, many cases are not seen until they have advanced to a point where treatment is very difficult and results most discouraging. It means that the public must be educated through the help of both dentist and physician to the fact that no matter how harmless the sore may seem, if it does not disappear in a maximum of two weeks, they should

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get immediate advice as to its treatment.

IRRITATIONS

It is the consensus of opinion that irritation is the cause of many malignant growths. Therefore, as a prophylactic measure, sources of irritation, such as worn out dental fillings and appliances and broken down teeth, should be removed. Highly seasoned foods and smoking and chewing tobacco act as irritants in some persons.

In many cases, the tissues of the lip seem to be extremely sensitive to the weather, cold or exposure to the sun, causing herpes or chapping, which disappears under treatment, only to recur again. This condition may not be the cause of tumor, but tenderness of the lips should receive careful attention as indicative of a susceptibility to lip cancer. In cancer of the lip, the patient often volunteers the information that cold sores have been common and that the one now present started the same way and looked the same as the others but did not respond to the usual treatment.

This story is told by many in whom cancer could have been prevented. Why these conditions are allowed to go on until cancer is present and cure is difficult, it is hard to understand. Cancer of the lip, as is true with other malignant conditions, causes no discomfort in the beginning and the patient does not become alarmed until it becomes an unsightly sore. Many reply when questioned that the lesion did not look bad until the past few weeks.

Many cases of mouth cancer give a history of mechanical irritation; which would indicate that this form of chronic irritation is a predisposing factor in the condition. It is best, therefore, to roentgenograph the teeth and examine all dental work yearly.

DENTURES

One of the commonest sources of irritation, often resulting in inflammation, is an ill-fitting denture. People wear dentures for many years knowing that they are loose, yet failing to have them remade or taken care of until the mouth becomes sore or swollen. They then apply for help, only to find that this may be given only under the most difficult conditions. Of the many kinds of dentures being made, such as rubber, gold, palladium and hecolite, rubber is, I believe, the common cause of irritation, for, after a time, it becomes porous, which makes it impossible to clean the microscopic fissures and interstices between the artificial teeth themselves. These small apertures harbor food particles, which, if allowed to remain, decay and have a decidedly disagreeable odor. If the ordinary rubber plate that has been carefully cleansed were to be cut in two, the odor would be unbearable. Hot or burning mouth may also be caused by this condition. The tobacco tar from smoking will turn a rubber plate black with a gummy deposit which it is impossible to clean off. Many dentures of this kind worn in the mouths of heavy smokers become so saturated that the rubber is penetrated through its whole thickness, this irritating tar-saturated rubber being in constant contact with the roof of the mouth and palate. Many mouths are red and inflamed from this condition. Who knows what may happen if it is allowed to continue? We may save a life if advice is given and the denture replaced with another which will be less irritant to the tissues. The resin plates are more satisfactory since they are more durable and more easily kept clean and smooth. They also register thermal changes, which helps maintain a more normal action of the mucous membrane. To date, I have never observed a case of cancer of the mouth where a gold plate was worn. By this, I mean a full denture, not crowns or bridgework. Gold takes a high polish, is absolutely smooth and is not porous, and therefore does not absorb tobacco tar. It is also easily cleaned and does not prevent the natural reflexes from reach-

ing the tissues. It would be well to bear this in mind when we find it necessary to make over a rough, irritating rubber plate.

BRIDGES

I have spoken of dentures, but there are many other sources of chronic irritation in the mouth, such as rough-edged crowns, sharp corners on bridgework and unpolished fillings. These conditions should be treated and corrected to help prevent the growth of cancer. It is very difficult to place amalgam or porcelain fillings, especially in posterior teeth, and make a smooth surface at the cervical edge of the cavity. Nearly all proximal cavities have an overlap of filling in the interproximal space which presses on the gum tissue causing constant irritation. We should definitely determine by taking roentgenograms immediately after filling whether all margins are smooth and no overhanging material remains. Gold crowns are very necessary for use in bridgework, but the difficulty of obtaining a perfect fit to the tooth and root is recognized by all the profession. Many crowns will be found on x-ray examination to be ill-fitting and a constant cause of irritation. A gold inlay or three-quarter crown can be more easily fitted and from a standpoint of cleanliness is far superior. A source of irritation in the mouth is thus eliminated. We are giving a great deal of attention to attempts to correct these errors and hope by so doing to eliminate what may be a contributing or a direct cause of cancer. Unfortunately, we have many to contend with who apparently never take care of their teeth. We see many cases of unkept mouths, badly broken down teeth with rough, sawlike edges and sharp, knife-like projections which should receive immediate attention.

Abscesses of the teeth cause destruction of bone, which may, in turn, be directly responsible for a cancerous condition. It is difficult to remedy this without the co-operation of the patient. Consequently, many of these people will develop lesions of the mouth owing to their own personal neglect.

In many instances, an accumulation of tartar will cause irritation of the tissues around the teeth. This will, in time, extend to the periosteum and then to the bone, and undoubtedly has a great tendency to cause benign growths, such as epulis, which eventually may become malignant. This could be remedied if the dentist would advise his patients as to how to keep their mouths clean. Routine examinations should be made once every four months, at which time all deposits of tartar should be removed. In certain patients tartar accumulates more rapidly than in others and treatment should be given more often. Each case should be studied separately. The service rendered will be greatly appreciated by all and the chance of serious lesions developing from this source will be overcome.

In many patients, the use of tobacco is also a factor. There is little question that it acts as any other form of chronic irritation. The mucous membrane of some mouths is much more susceptible to tobacco than is that of others. Some persons seem to be able to use tobacco continuously, with no ill effects. Others who use a very small amount develop mouth irritation. Those who chew seem to be among the majority of sufferers as the quid held against the mucosa of the cheek is a constant irritant. The tissues always have the appearance of being rough, burned, and thickened at the point of contact. Of course, it is difficult to prove that tobacco is a cause, but since the percentage of use in a reported series of cases of cancer of the tongue varies up to 85, we assume that it may be a direct cause. There are mechanical devices which also act as a direct irritant in the mouth. In pipe smokers, the stem is in direct contact with the lip. This becomes saturated with tobacco tar, which, in turn, is rubbed into the lip and, combined

with hot smoke, is extremely irritant, first causing a dryness or cracking of the lip, which, if neglected, may become malignant. Nails held in the mouths of the cobbler, the carpenter and the carpet layer many times cause soreness of tongue and lips. It has been stated that 25 per cent of the cases of cancer of the tongue have as their first symptom irritation.

LEUKOPLAKIA

There is no question that leukoplakia is more apt to develop in mouths where there is constant irritation. Leukoplakia, or white patches, in the mouth is innocent until the lesions become thick and leathery, when their complete removal is indicated. The papillary as well as the syphilitic type found on the tongue and also at the angles of the mouth may develop into malignancy. It has been stated that cancer can develop only from lesions of long standing which crack and become ulcerated. Leukoplakia is seen most frequently between 45 and 60 years. The usual lesion is somewhat rough, grayish white and slightly raised. It may be found on the cheek, tongue, lip or palate. The cause is not known, but the elimination of all irritants is a great help in its cure. By eliminating every cause of irritation in those mouths which seem to be susceptible, we have, at least from a prophylactic standpoint, assured that person a future with much less chance of developing a cancer. People who keep the teeth and mouth well cared for rarely develop leukoplakia or mouth irritation. Blair states that early observation by the dentist or physician will eliminate at least 50 per cent of mouth cancer.

In this country, only 10 per cent of females as against 90 per cent of males develop cancer of the mouth. It is, therefore, definitely a disease of the male. Syphilis is a distinct factor in cancer of the tongue; that is, in the cases in which there has been a scar in the tongue from syphilitic glossitis. Cancer of the tongue in a syphilitic patient usually has a characteristic appearance.

The conditions here mentioned often lead to cancer of the mouth. If they had been treated, cancer could probably have been avoided. Much, therefore, can be done to prevent the development of cancer in the mouth, or even precancerous conditions, by removing all sources of chronic irritation. The mouth should be kept absolutely clean, all carious teeth either removed or filled. I consider all dental appliances foreign bodies and believe all patients should be advised to so regard them. Dentures are a necessity, but the contour of the gums and mouth changes, and frequent adjusting to take care of this condition should be advised. Teeth should be so set up as to articulate properly, the sides not too high, and the palate should be comparatively smooth. Last, but most important, dentures should receive attention as to cleanliness. This is often overlooked. The majority of people clean dentures but once a day. It should be done after each meal, to prevent food from fermenting and becoming irritant.

Therefore, I say: Eliminate all irritants and advise absolute cleanliness at all times.

The greatest contribution that can be made by the dental profession in regard to cancer of the mouth is to see that septic, broken teeth and poorly fitting plates are removed from the mouth, that excessive use of tobacco be stopped and that syphilis be adequately treated. These measures should be undertaken whether signs of irritation are present or not.

80 Boylston Street.

LINGUALLY MALPOSED CUSPIDS AND SECOND BICUSPIDS

By R. C. Willett, D.M.D., F.A.C.D., Peoria, Ill.

MAX BORN,[1] in "The Restless Universe," makes frequent use of the term "immutable law," but gives as his conclusion that the "indeterminancy" of such laws lies in the fact that if we attempt to apply them we must know the initial conditions of a situation and that a complete knowledge is in fact impossible and even theoretically impossible. "You simply cannot practice Quantum Theory unless you admit this certainty about uncertainty. There seems but one way out; namely, *statistical interpretation.*"

For the research worker, Nature becomes the one reliable historian of time because she is invariably non-partisan, often cruelly impressive in her methods for the recording of facts, and, save for notable exceptions, which may be the working out of some unknown part of the law, and therefore not exceptions, she is the inflexible welder of causes and effects.

While admitting this "certainty about uncertainty," it is only by a comparative study and clear observation of what has happened under certain conditions that we are able to predict with reasonable assurance a repetition of that happening under similar conditions in the evolution of human dentition. "Uncertainty" is minimized when predictions are made from "statistical interpretations."

(Read before the Section on Orthodontia at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

1. Born, Max: The Restless Universe. (Translated by W. M. Deans.) New York: Harper and Brothers, 1936.

In an examination of the skull of a normal white child whose age was approximately 6 years, if the outer plate of alveolar process and cancellated tissue is cut away, it will be observed that the roots of the deciduous teeth and the forming permanent teeth occupy nearly all internal space of the maxillary bones and mandible. This ensemble of forming hard-tissue structures is a compact mass and, in its evolutionary unfolding, is very susceptible to morbid influences that may be inherent in the formation of the organism or the result of acquired injurious influences arising during the life of the organism.

THE PERMANENT CUSPID

At this particular period of a child's life, namely, approximately 6 years of age, the permanent cuspid crowns are usually fairly well formed and some specimens even show a rudimentary root formation. The base of the maxillary cuspid crypt at this time is situated midway between the infra-orbital foramen and the outer anterior border of the maxillary bone that forms the external lateral wall of the nasal passage.

It will be further observed that, in most specimens of this age, the deciduous cuspid root is superimposed on the permanent cuspid crown approximately 2 to 3 mm. At the approach of and during the period of transition from deciduous dentition to permanent dentition, changes occur in the relationship of the developing permanent cuspid and the apex of the deciduous cuspid root. When the

permanent lateral incisor emerges from its crypt, the tip of the deciduous cuspid root usually rests on the mesiolabial surface of the permanent cuspid crown. Later, when the permanent central and lateral incisors are fully erupted, the permanent cuspid appears to be carried forward with the general growth of the denture, and the resorbing deciduous cuspid root is then superimposed on the distal surface of the permanent cuspid crown.

In the normal course of dentition, simultaneous changes take place in the relationship of the mandibular deciduous cuspids and the developing permanent cuspids. In a dry specimen from a child approximately 6 years of age, the base of the permanent cuspid crypt is close to the lower border of the mandible, the thickness of the bone in that area seldom measuring more than 2 mm.

The malalinement, retarded eruption or fixed impaction of a permanent cuspid may result from malposition of a tooth germ, malformation of a proximating tooth germ, delayed resorption of a deciduous cuspid root or disturbed function as a consequence of carious proximal defects of the deciduous molars that terminate in a partial or total premature loss of these teeth. These causes do not necessarily operate singly. Two or more of them may be the combined cause of malposition of a permanent cuspid.

Lingually malposed maxillary permanent cuspids not only are common anomalies in dentition of the modern white man, but are also occasionally found in the skeletal remains of prehistoric man that showed negroid and Mongolian characteristics.

Figure 1 shows an erupted cuspid in the palatal border of a specimen recovered from an ancient burial ground on the bluffs bordering the Illinois River near Peoria. The symmetrical development of the dental arch and associated structures does not appear to have been materially affected by the presence of the malerupted left cuspid. In the examination of prehistoric skulls, a labially malposed cuspid has seldom been found. If an anomaly of position of this particular tooth does exist, it is usually in a lingual malposition similar to the one shown in this illustration.

Fig. 1.—Specimen from Illinois River Valley prehistoric man; lingually malerupted maxillary cuspid.

Figure 2 shows a permanent maxillary cuspid in lingual malposition that may be attributed in a measure to the fact that

the tooth germ is out of line to a slight degree from its normal position, and to a delayed resorption of the deciduous cuspid root. The treatment following the extraction of the deciduous cuspid, in a case of this type, is quite simple and can usually be accomplished without other mechanical aid than vigorous massage with the thumb applied to the palatal cuspid area. If, when the cuspid erupts, its inclination is still lingual to correct alinement, leverage can be brought to bear by biting on an orangewood stick in such a way that the tooth is forced labially. In case the patient's cooperation is not secured, a palatal vulcanite plate, as shown in Figure 3, will aid in guiding the erupting cuspid into proper alinement.

Figure 4 shows a permanent cuspid in lingual malposition, which can be directly attributed to the fact that the tooth germ is out of line from its normal position. It may appear from the roentgenogram that sufficient space might have been developed for recovery and alinement of the cuspid. On three occasions between the ages of 12 and 16 years, the crown of the cuspid was surgically exposed, but it showed no tendency to erupt or change its position. Because of its close relationship to the lateral incisor root, and other physical conditions of the denture contraindicating orthodontic correction, surgical removal of the cuspid was considered justifiable.

Fig. 2.—Permanent maxillary cuspid in lingual malposition to slight degree.

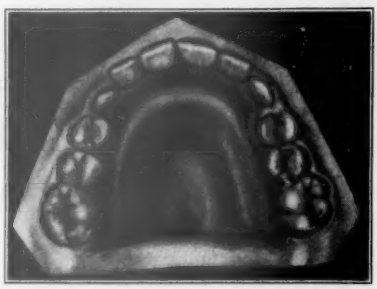

Fig. 3.—Palatal vulcanite plate to aid in guiding erupting cuspids into proper alinement.

Figure 5 shows the lingual malposition of the maxillary left cuspid that, because of the inclination and of facts gathered in compiling the case history, cannot be entirely attributed to the fact that the tooth germ is out of line from its normal position. The mother stated that because of "toothache" when the boy was about 6 years old, several of the "first teeth" were extracted. The effect of that action was evident in the unilateral collapse of the dental arches. Devoid of deciduous molar support, the bicuspids and permanent molars had drifted forward. The prolonged retention of the deciduous cuspid had withheld the posterior teeth from complete encroachment on space for the permanent cuspid. At the age of 14 years, further collapse of the mandibular arch occurred as a result of the ill-advised extraction of the left first bicuspid by the dentist who had been entrusted with the boy's dental welfare, and who believed that such a procedure would provide ample space for the erupting cuspid in that area. The complications resulting from these misadventures in dental care cloud the outlook for a successful orthodontic correction.

Figure 6 shows a mandibular right cuspid in a lingual malposition that precludes the probability of successful orthodontic correction. Because of the close relationship of the tooth to the lateral and central incisor roots, surgical interference is not

advisable. Future developments in this case will determine the advisability of retention or ultimate removal of the tooth. In this case, there was no history of proximal caries in the deciduous molars or external injury in infancy or early childhood. The abnormal position of this cuspid can be attributed to an inherent condition. A twin brother exhibited a similar anomaly on the left side of the mandibular arch. It was further observed that the same characteristic anomaly was of common occurrence among immediate paternal relatives.

Figure 7 A shows a dental anomaly in the case of a young woman, aged 22 years, who would have possessed a nearly ideal functional occlusion except for the too prolonged retention of the maxillary left deciduous cuspid and the delayed eruption of the permanent cuspid. It may be reasonably assumed that the lingual malposition of the unerupted permanent cuspid was due to a slight malposition of the tooth germ, and eruption was later retarded because the deciduous cuspid root was not resorbed. Until the roentgenographic examination was made, this patient, like many others possessed of such an anomaly of dentition, supposed that the permanent cuspid was congenitally absent.

Fig. 4.—Permanent maxillary cuspid that showed no tendency to erupt after surgical exposure on three occasions.

Fig. 5.—Permanent maxillary cuspid erupting in lingual malposition, attributed more to prolonged retention of deciduous cuspid than to malalinement of tooth germ.

In the treatment of this case, the deciduous cuspid was removed, July 8, 1933, and the permanent cuspid was, at the same time, surgically exposed. After the tissue healed, the patient was instructed to massage the palatal cuspid area, applying pressure to the distal aspect. Figure 7 B, eight months later, February 1934, shows that the cuspid had not only moved downward, but also was only slightly superimposed on the lateral incisor root. Active treatment with an appliance was postponed until January 1935. The appliance consisted of right and left first permanent molar band anchorages and a cast overlay anchorage for the cuspid so shaped on the lingual surface that it formed a secure resting place for the finger spring wire that was soldered to a 0.028 gage rigid base wire anchored with "Spencer" double pin and tube locks to the molar bands.

Figure 7 C shows the position of the cuspid tooth January 25, 1935, when the first adjustment of the appliance was made. On comparing this roentgenogram (C) with the one taken June 5, 1933, a favorable change is evident in the positions of the cuspid and the bicuspid roots. This favorable change of position is credited to the thumb massage in the palatal cuspid area. In comparing roentgenograms A and C, attention is called to the care that was taken in securing the same degree of angle. This can be proved by

a comparative measurement of the lateral incisor, cuspid and first bicuspid.

Between January 25 and August 5, a period of six months and eleven days, the finger spring wire was adjusted six times. A vulcanite retention plate similar to the one previously shown in Figure 3 was made at that time to retain the cuspid in alinement until it was completely erupted. Figure 7 D shows the complete eruption and alinement of the tooth, which, aside from the surgical exposure, was accomplished through constant light pressure and without discomfort for a mature adult patient.

THE SECOND BICUSPIDS

In a comparative study of the development of the second bicuspids, it will be

Fig. 6.—Cuspid in abnormal position as result of inherent characteristic.

observed at this particular period of the average normal white child's life, namely, approximately 6 years, that although the permanent crowns are formed, the second bicuspid crowns have attained only one-fourth to one-half of their eventual size. When normally situated at this stage of their development, the second bicuspids embedded in their crypts do not encroach on the roots of the second deciduous molars. They have a freedom of space in which to develop that does not exist in the relationship of developing permanent teeth situated anterior to them in the dental arch.

At the beginning of root formation, the normally situated developing second bicuspid advances until its crown lies well within the widely spread roots of the second deciduous molar. The relationship of the maxillary second bicuspid crown and the roots of the second deciduous molar cannot be clearly shown in the roentgenogram because the lingual root of the deciduous molar is superimposed on it. In the mandibular situation, the position of the bicuspid crown is not obscured by superimposed dense tissues lingually or buccally from it, the bifur-

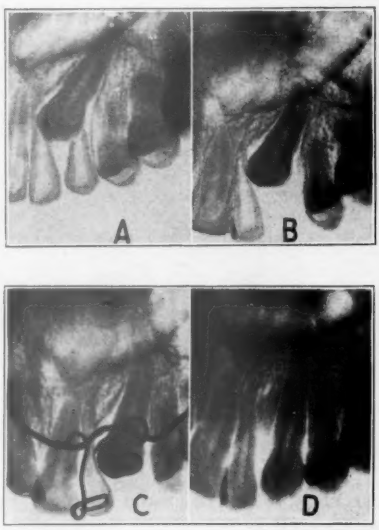

Fig. 7.—A, straight angle 65 degrees, June 5, 1933. B, February 17, 1934. C, straight angle 65 degrees, January 25, 1935. D, June 11, 1936.

cated roots of the second deciduous molar enveloping its mesial and distal surfaces. If the course of eruption of the first permanent molar is not misdirected and no abnormality has resulted from proximal structural defects or the premature loss of the deciduous molars, which interferes with the natural process of dental arch growth and permits a collapse of the space that the second bicuspid should occupy, a

second bicuspid is rarely found in other than normal alinement with the proximating teeth when fully erupted. Attention is called, however, to the fact that these important "ifs" when not observed and properly controlled become most potent contributors to "uncertainty" in otherwise all but certain final alinement of the teeth.

While the range of malposition of a permanent cuspid is variable, and clinical statistical records show more labial than lingual malpositions of these teeth, the presence of a buccally malerupted second bicuspid is rare. Clinical statistical records also show a frequent congenital absence of one or more second bicuspids and occasionally the presence of one that is malformed. When malformation of a second bicuspid involves the root as well as the crown, the tooth has become of little value as a functioning unit in the dental arch and its retention is useless.

A B

Fig. 8.—A, malformed left mandibular second bicuspid. B, normally formed right mandibular second bicuspid.

Figure 8 shows a mandibular second bicuspid of this type lodged between the roots of the second deciduous molar and at right angles to its normal inclination. In this case, because of physical conditions and the parents' indifference to adequate dental care, the second deciduous molar and the malposed second bicuspid were removed and voluntary closing of the space was permitted. Figure 9 shows that by the time the girl reached her fourteenth year, there was a fairly satisfactory functional occlusion of the buccal teeth on the affected side.

The case of Mary B. (Fig. 10) again demonstrates the uncertain trend of dental arch growth when deciduous molars are prematurely lost, and also the variable effects of such losses in the eruption of the second bicuspids.

This case was first brought to my attention when the child was 6 years and 2 months old. Her general health was exceptionally good considering the fact that she had suffered the complete loss of three mandibular deciduous molars and that three second deciduous molars were hopelessly diseased. Through a lack of parental cooperation following the making of the casts shown in Figure 10 A, the child failed to return for a period of five years and four months, when she again appeared, at the age of 11 years and 6 months. The casts shown in Figure 10 B were then made. These casts show that Nature had dealt kindly with the mandibular development in spite of the loss of three deciduous molars prior to the age of 6 years.

In the occluded casts (Fig. 10 B), it will be observed that the first permanent molars and incisors were in functional occlusion and that no marked deficiency existed in vertical development. An examination of the occlusal view of these casts shows that while a complete loss of the second bicuspid space had occurred in the maxillary arch, space for the erup-

tion of the mandibular second bicuspids had not been entirely lost. The casts shown in Figure 10 C were made eleven months later.

In comparing the occluded casts in Figure 10 B with the occluded casts in Figure 10 C, it will be observed that a change had occurred in the relationship of the upper and lower incisors. The case is now assuming characteristics of an anterior malocclusion (Angle, Class III). On comparing the occlusal views of the casts, it will be observed that during the eleven months that elapsed between the making of these casts, space had developed between the maxillary first permanent molars and first bicuspids, but it was less affected by injuries resulting from a premature loss of second deciduous molars than is the growth of corresponding segments of the maxillary arch from similar injuries. Lewis, in his writing, calls attention to this difference between maxillary and mandibular arch growth in a comparative study of how the premature loss of the second deciduous molars may affect dental arch growth and the damaging effect of such losses on occlusion of the permanent teeth when they erupt.

AN ERROR OF JUDGMENT IN THE REMOVAL OF MAXILLARY SECOND DECIDUOUS MOLARS

In Figure 11 A, it will be observed that the maxillary first bicuspids and perma-

Fig. 9.—Left, condition of occlusion following removal of second deciduous molar and malformed lingually inclined second bicuspid. Right, voluntary closure of second bicuspid space.

by no means sufficient to accommodate the lingually displaced second bicuspids.

Since the incisive contact of the anterior teeth is now in a reversed relationship to what it was when cast B was made, and there being nothing in the way of functional activity to check forward growth of the mandible, sufficient space may develop for a nearly normal eruption of the mandibular second bicuspids.

If sufficient "statistical interpretation" could be compiled and systematized for an analytic study of this particular problem of dentition, it would probably show that mandibular dental arch growth is

nent cuspids were erupting. The roentgenograms indicated that the second bicuspids were normally situated and sufficiently developed to take their places in the dental arch if the second deciduous molars were out of the way. After a brief period of corrective treatment directed to alinement of the incisors, all appliances were removed and the second deciduous molars were extracted. The patient was instructed to report in a few weeks, but six months elapsed before his return. Figure 11 B shows what happened during his absence. The eruptive force of the rapidly developing second

Fig. 10.—A, premature loss of three deciduous molars prior to eruption of first permanent molars. B, collapse of maxillary arch, more pronounced than that of mandibular arch. C, cast showing change occurring in occlusion between ages of 11 and 12 years.

permanent molars had carried the first permanent molars forward, and the right and left second bicuspids were doomed to erupt in a lingual malposition.

How easy it would have been to avoid such a dental catastrophe if a simple preventive measure had been applied immediately after removal of the second deciduous molars! Figure 12 shows how simply an appliance could have been constructed to prevent the anterior migration of the first permanent molars, maintain the anteroposterior dimensions of the dental arch and permit a normal eruption of the second bicuspids. The appliance consists of well-fitted bands for the first permanent molars that are connected on the lingual aspect with a rigid

to my attention by a county nurse, the complaint being that teeth were erupting in the palate. As will be observed in the occluded casts (Fig. 13 A), there was a normal functional occlusion of the upper and lower teeth from the first bicuspids forward. The occlusal view of these casts shows a palatal border eruption of the right second bicuspid, and the bulge of soft tissues on the left side indicates that the left second bicuspid was taking a similar eruptive course. The true position of the left maxillary second bicuspid was verified by roentgenograms.

Because of the fact that, regardless of the malerupting bicuspids, the boy possessed a good functional occlusion of twenty-six teeth, removal of the lingually

Fig. 11.—A, cast showing error in judgment in removal of second deciduous molars. B, cast showing first permanent molars carried forward by eruptive force of rapidly developing second permanent molars, with closure of second bicuspid spaces.

0.040 gage wire. For the lower appliance in the case shown for illustration purpose, the wire is adapted to the lingual ridge and rests on the lingual surfaces of the incisors just above the septal tissues. In constructing the upper appliance, the wire extends from the molar bands to the cuspids and is connected with a section of wire that conforms to the palatal surface. The free ends of this wire are adapted to the distoproximal surfaces of the cuspids close to the gingivae.

The case of Edward R. (Fig. 13), then aged 13 years and 5 months, was brought

malposed second bicuspids might have appeared justifiable, but because of an impairment of the nasal respiratory tract, which might be further damaged by the removal of the second bicuspids, such a course of action was not considered advisable. The boy suffered from asthma, and this ailment, associated with constriction of the nasal passages, seriously affected respiration. Mentally, the boy was dull.

It was considered advisable to develop space and establish alinement of the malerupting bicuspids rather than do any-

Fig. 10.—A, premature loss of three deciduous molars prior to eruption of first permanent molars. B, collapse of maxillary arch, more pronounced than that of mandibular arch. C, cast showing change occurring in occlusion between ages of 11 and 12 years.

thing that might reflect unfavorably on respiration. To establish this alinement without subjecting the boy to a long period of corrective treatment, the maxillary second molars were extracted. Another reason for deciding on such a course of action was that, owing to general physical debility and retarded growth, a development of the dental arches sufficient to accommodate thirty-two functioning teeth seemed by no means feasible.

Without disturbing the existing functional relationship of the upper and lower

Fig. 12.—Simple type of appliance for intercepting anterior migration of first permanent molars.

eight anterior teeth, the maxillary first permanent molars were moved back until they were in normal occlusion with the mandibular first permanent molars. By this action, space was developed between the maxillary first permanent molars and first bicuspids for the alinement of the second bicuspids. Figure 13 D shows the functional occlusion of twenty-eight teeth at the age of 17 years. The maxillary third molars have taken the places of the second molars and in function occlude with the mandibular second molars. To eliminate the possibility of later complications, the mandibular third molars were removed. From the time that development of space for the malerupting second bicuspids was started, there was a continuous improvement in the respiration, general health and alertness of mind.

In the case of Albert G. (Fig. 14), aged 18 years and 4 months, the existing malocclusion involved the function of twenty-eight teeth, the complicating factor being lingual impaction of the left mandibular second bicuspid.

Regardless of what the basic cause of this anomaly of dentition may have been, Nature had failed in the redevelopment of space for the eruption of a normally formed bicuspid. In this particular case, improvement in functional relationship of the teeth depended entirely on whether space in the mandibular arch could be sufficiently developed for the eruption of the impacted tooth. In developing the dental arches and increasing the bicuspid space, no lingual wire attachments were employed. It was assumed that unrestricted tongue pressure would work to the same advantage in correcting the lingual inclination of the bicuspid during its eruption as thumb massage would in correcting abnormal inclination of the maxillary cuspids. To ease the way for its eruption, the overlying cancellated tissues were incised and freely removed as soon as the space was sufficiently developed. At no time during the corrective or postmaintenance periods of treatment was it found necessary to make an attachment to the erupting tooth, the tongue pressure having proved effective.

SUMMARY

1. *The Permanent Cuspid.*—From a comparative study, it seems that lingual malposition of the cuspids can be attributed primarily to malalinement of the tooth germ from a normal position. In

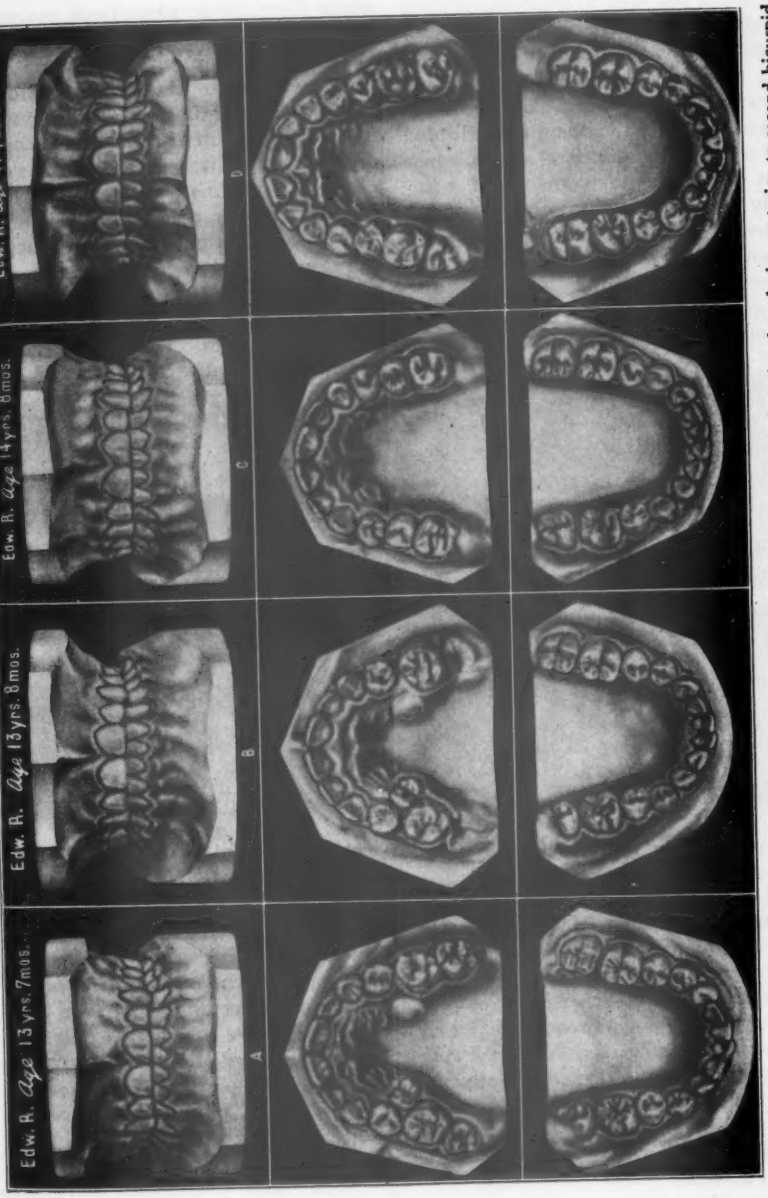

Fig. 13.—A, maleruption of maxillary second bicuspids that did not interfere with functional occlusion anterior to second bicuspid area. B, cast after removal of maxillary second molars in preparation for corrective treatment. C, cast showing maxillary third molars occupying second molar space.

substantiation of this conclusion, the occurrence is observed to be as frequent in the otherwise normal denture as it is found to be in the various classified malocclusions. Even though the existence of such an anomaly is discovered early, little opportunity for effective therapy is afforded until the permanent incisors and bicuspids erupt. The exceptions are: 1. If a lingually malposed cuspid is associated with abnormally narrow dental arches, development of the dental arches to normal proportions is imperative. 2. If, in any type of case, there is a prolonged retention of a deciduous cuspid, the timely removal of it will modify the complication. 3. If massage is properly applied, it will prove a valuable therapeutic aid. Massage may be applied to advantage before surgical exposure of a malposed cuspid, or afterwards. Such treatment, when judiciously carried out, shortens the corrective appliance period of treatment. Due credit must be given to Walter L. Hyde for suggesting massage as a preliminary aid in the treatment of lingually malposed teeth.

Fig. 14.—Development of space for eruption of mandibular left second bicuspid.

2. *The Second Bicuspid.*—A comparative study of lingually malposed second bicuspids justifies the conclusion that when these teeth have been normally formed, any existing malposition can be attributed to an injurious influence, the effective control of which has been proved possible. Outstanding among injurious influences are the misdirection of the course of an erupting first permanent molar and neglect of proximal structural defects of deciduous molars, the centralized ill-effect of which reflects on the normal eruption of the second bicuspids. When it becomes necessary, loss of second bicuspid space should be recovered with buccally attached appliances. This will permit of tongue pressure, which, in many instances, has proved as effective in guiding a lingually malposed second biscuspid into correct alinement as is the common use of spring metal lingual wire appliances.

As a last word, I desire to stress the enormous debt of the dental profession at large to its pioneer members who, through their research, carefully kept records and individual "statistical interpretation," have justified the conclusions here set forth. To the young or the old practitioner, the value of such statistical

information, when systematically recorded, is inestimable, but the vast jungle of biologic research is still comparatively uncleared and its explorers are too few. Abnormality has no geographically defined boundaries, and the systematically kept case records of even the seemingly obscure practitioner may illuminate the none too well lighted closets of biologic investigation pertaining to problems of human dentition.

Jefferson Building.

GINGIVAL INFECTION AND RESISTANCE

By P. H. Belding, D.D.S., and L. J. Belding,* M.D., Waucoma, Iowa

As a prelude to our discussion, we acknowledge our indebtedness to those who have gone before, particularly to Hans Zinsser and David T. Smith.

There is a no more neglected field in the entire realm of preventive medicine than that of diseases of the gingival structures. This is rather difficult to understand in view of the fact that the gingivae are, perhaps, of all human tissue, the most frequently infected.

Infection implies bacterial activity, and in speaking of the bacteria to be found in the oral cavity and of their potentialities, it might be interesting to note that the gingival structures may, in addition to the typical oral flora, normally harbor every form of bacterial life common to the environment in which the host exists.

In a previous communication,[1] we have shown that the normal oral flora are made up essentially of the spirochetes and the leptothrices, and ordinarily these organisms have only slight pathogenic properties. When the resistance of the gingival tissues is sufficiently lowered, they may become actively pathogenic and, in common with other pathogens, they may progressively increase in virulence by passing through successive courses of favorable environmental conditions.

When it is considered that the gingivae are delicately responsive to almost every type of perverted function, such as dietary deficiency, dysfunction of the internal secretory organs, blood dyscrasia and infectious disease, it becomes readily apparent that, through their loss of resistance, they may offer an excellent environment for the growth and multiplication of the ever-present bacteria, particularly the anaerobes.

The unchecked growth of these microorganisms, that is, the spirochetes and the leptothrices, may have grave potentialities not alone as to their immediate host, but, by the enhancement of virulence, also to every person with whom they come in contact. This is particularly true of certain strains of the oral spirochetes which we have frequently encountered in the diseased gingivae of children slightly over 2 years of age.

The initial lesions of specific gingivitis (fusospirochetal disease of the gingivae) are a serious dental problem within themselves; but when it is considered that the fusospirochetes produce lesions in many other parts of the body, which not infrequently terminate in death, it is apparent

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that the disease offers a stinging challenge to the proponents of preventive medicine.

In that the primary localization of the fusospirochetes is in the subgingival region, prevention and control of this disease should be essentially a dental problem. There is perhaps little we can give to the experienced periodontist which is in any sense new and original. We do believe if the rank and file of the profession are to accept the challenge of this disease, they must constantly hold before themselves the mental image of normalcy, and any deviation therefrom must be recognized and significantly interpreted.

We shall briefly present certain clinical observations that have been made in the course of our studies of the diseased gingivae of children and adolescents. It has been our experience that, regardless of the resistance-lowering factor, the fusospirochetes are, in most cases, the original invaders in gingival infection and that they are, in large measure, responsible for the characteristic symptoms. After the initial invasive process, the untreated course of the disease is unpredictable. Ordinarily, in the child, if oral hygiene is neglected, the symptoms are progressively localized and may be relatively acute for varying periods of time. Apparently, some latent defensive mechanism is aroused; for, without treatment, there is a remission of the symptoms, and the further progress of the disease is of fairly constant chronicity, with occasional exacerbations that may be generally attributed to the appearance of various resistance-lowering factors.

It has furthermore been our experience that the bacterial flora associated with the acute and chronic conditions are essentially identical. We have had under observation several cases of the fulminating type in children less than 3 years of age. The initial reaction has been rapid and severe and, in the early course of the infection, confined to the subgingival region. Ordinarily, we have found that children, at the time they enter school, are relatively free from any type of gingival abnormality. During the transitional period of the dentition (deciduous to permanent), it is apparent that in those children who do not practice oral hygiene, the resistance of the gingival structures is at this time sufficiently lowered to make possible a microbial invasion, of varying intensity.

The prevention of gingival disease should not be a serious problem; for we have found that a supervised oral hygiene program will maintain sufficient local resistance to prevent gingival infection in the majority of children that we have had under observation.[2]

We do not wish to make the dogmatic assertion that all cases of periodontal disease had a like inception, but we believe that a correlation of observations made in various parts of the country should give us a definite idea as to just what the prepyorrheic lesion actually is, and, with this information available, means of prevention could be devised that would be universally applicable.

Gingivitis is ordinarily defined as "a disease process which effects a change in the tissues surrounding the tooth root which have their origin in the gingivae or the periodontal membrane." The ordinary course of the disease is relatively mild and the course of an acute case may, at any stage in its progress, revert to a chronic condition.

In our control group, we have had under observation series after series of families wherein the course of the disease had been so typical that a progressive study of the gingival conditions of the older members (8-50 years of age) gave a definite progressive prognosis of just what was going to happen to the normal gingivae of the younger members of the family (3-6 years of age).

It has been our experience that all cases of neglected fusospirochetal gingivitis terminate in a condition that is indistinguishable from a chronic pyorrhea

and as far as dentistry is concerned, specific gingivitis is the precursor of the majority of cases of periodontal disease.

The question arises, Are pyorrhea and acute Vincent's infection different manifestations of the same infection? We believe that the question can best be answered by a general study of infection and resistance.

INFECTION AND RESISTANCE

The new concept of dentistry as a specialty of medicine necessitates a broader knowledge of the basic factors underlying disease processes. In order that the approach be logical, it is necessary that dentistry utilize all available information of a medical nature that will supply the knowledge whereby it will be enabled to consistently recognize and logically interpret abnormality.

Experienced dentists are, on the whole, familiar with oral normalcy and its variations; yet most of them are decidedly impotent when they attempt to interpret oral pathosis. This being our immediate problem, the scientific approach must come through a study of the broad phenomena underlying disease. Among other studies, this necessitates a familiarity with the subject of resistance and infection.

Hans Zinsser, in his monumental work "Infection and Resistance," gives us this definition: "Infectious disease biologically considered is the reaction which takes place between invading microorganisms and their products on the one hand and the cells and fluids of the animal's body on the other." Infectious disease, then, is the product of two variable conditions. This definition is, in reality, the result of many years' scientific research. It may be stated that it had a philosophic origin in the seventeenth century, when Robert Boyle prophesied that the nature of infectious disease would be solved by him who correctly interpreted the process of fermentation.

Progress was pitifully slow in those early days, and it was not until 200 years later that Boyle's prophecy was fulfilled, by the work of several investigators, the most prominent of whom was Pasteur.

Sixty-four years ago, Pollender discovered the anthrax bacillus in the bodies of animals that had died of what was then a mysterious malady. Since that time, remarkable progress has been made. In fact, the period of investigating the cause of infectious disease is now approaching its maturity. The micro-organisms that cause most of the infectious diseases have been discovered, but in spite of a vast accumulation of knowledge of microorganisms, including their morphology, the study of immunity is still in its infancy. Yet so husky is this infant that it gives promise of some day telling us a great deal of the defensive powers of a living body against infection.

The story of microbes and their hunters is as interesting and romantic as that of the great crusades; for since Anton Leeuwenhoek first gazed on that mysterious world of the magnifying lens, opinion has differed. Scientists have allied themselves with different beliefs. Opposing war camps have been established and, in some instances, these groups of pioneers have fought each other with all the strategy and skill of great field marshals. In others, they have indulged in silly quarrels that were in no way edifying.

Robert Koch's discovery that bacteria could actually cause disease gave impetus to errors of enthusiasm. The early research, though of great significance, was narrow; for, during the days of the development of bacteriology, the attention of the investigators was directed primarily toward the discovery of the bacteria that caused various infectious diseases and this without a consideration of modifying factors. It was thought that infectious disease could be produced simply by bringing a susceptible person in contact with organisms that were known to cause disease. Fortunately for all of us, the

matter was not quite that simple, and today it is definitely known that the conditions which determine infection are dependent on many secondary conditions.

Throughout nature, we find bacteria in abundance. The air, the soil and the water we drink contain many of them. The surface of our body is literally covered with them. The respiratory tract and the oral cavity, as well as the intestines, so consistently harbor bacteria that their presence is considered normal. Perfectly healthy individuals have been known to harbor pneumococci, the diphtheria bacilli and other pathogenic micro-organisms too numerous to mention, and still offer no evidence of infectious disease. Infection, then, is not determined by the presence of pathogenic micro-organisms in or on the body of a susceptible animal. It is further necessary that pathogenic micro-organisms find a place of lodgment in or on the animal's body that offers a suitable environment for their growth and multiplication. An infection, then, has two factors, the invading organisms and the invaded body. These factors are always variable, and, as long as we live, there is a constant battle between them, with first one and then the other in the ascendancy. It is the result of the initial skirmish between these variable forces which determines whether infection is to take place.

Before the discovery of the interrelationship of these variable forces, scientists fought bitterly over the subject of what caused disease. The story is told that shortly after Robert Koch had discovered and successfully grown the cholera vibrio, Professor Pettenkofer, who was a leader of the skeptics, took a test tube of the cholera organisms and swallowed them, then shouted his defiance to high heaven: "Bacteria do not cause disease." To this day, it has never been fully explained why he suffered not at all as a result of his heroic gesture. So we see that Koch and Pettenkofer were both partly right.

In this study, we are attempting to correlate truths that are seemingly opposed to each other. We shall first briefly discuss bacteria and their relation to disease. In Nature, we find innumerable bacteria and protozoa, but fortunately only a limited number of these are capable of becoming parasitic on the bodies of the higher animals and a still smaller number are capable of causing disease. Roughly speaking, bacteria may be classified as pathogenic and nonpathogenic or as parasitic and saprophytic. The strictly saprophytic bacteria are incapable of causing disease themselves, but they may become lodged in dead tissues of the body and coincidently with their growth and multiplication produce bacterial poisons, the presence of which, when taken up by the blood stream, often causes serious symptoms.

Some bacteria, such as the diphtheria bacilli, are known as partial saprophytes. Ordinarily, these organisms do not invade the tissue beyond the point of the initial lodgment, and the general symptoms of the disease are due to toxemia rather than to the direct activity of the organisms.

True pathogenic bacteria, through perhaps centuries of association with higher animals and man, have adapted themselves to their environments; that is, the bodies of animals and man, and they will always cause a specific disease if the tissues with which they come in contact are in a suitable condition for their reception, retention and multiplication.

Zinsser states that "true infection may be considered as the invasion of one species by individuals of another, associated with the ability of the latter to functionate within the cells of the former." Living cells possess a characteristic of resistance to an invasion of things foreign to their nature. This is called vital resistance, and even today it is not well understood just

what this thing called life actually is. Frogs' eggs deposited in water containing bacteria remain resistant as long as alive. Immediately on death, with no visible changes in their makeup, they are invaded by micro-organisms and eventually destroyed. The tissues of the living human stomach are not affected by the digestive juices. However, after death, these juices immediately start to digest the stomach walls.

Resistance, then, which is in great measure an attribute of living substances, is, as we have before mentioned, called vital resistance. When vital resistance is overcome and micro-organisms enter the tissues, the process is abnormal and strictly defined as infection.

It is now well understood that the bacteria of infectious diseases when passed rapidly from one individual to another gain tremendously in virulence and, for this reason, many epidemics that in the beginning were mild and symptomless may become very dangerous as time goes on and specific bacteria are passed from individual to individual.

Bacteria cause disease in various ways. The bacteria themselves may multiply very rapidly and actually eat their host. Bacteria may form as products of their own metabolism very strong poisons known as exotoxins; or, when destroyed in a body, they may liberate poisons, which are known as endotoxins. Thus, staphylococci may produce substances which injure white blood cells. Other bacteria produce poisons which injure red blood cells, causing anemia and reducing the resistance of the host.

The criteria which determine infection may be briefly grouped as follows: 1. Pathogenicity. 2. The path by which the organisms gain entrance. 3. Quantity or dosage. 4. Susceptibility.

Types of Infection.—In bacterial infection in an animal, there are usually a very definite and specific chain of symptoms. This is so well recognized that diagnosis is often based solely on the interpretation of symptoms. However, one and the same group of micro-organisms may cause entirely different clinical conditions, as manifest by the protean nature of syphilis lesions. Two or more types of organisms may live together and by their association produce destructive lesions. This is called symbiosis. One of the common examples is the pathogenic association of the organism of Vincent's infection with the diphtheria organism, in which case the clinical diphtheria is apt to be considerably more severe than when the diphtheria bacillus is found alone except for the inhabitants of the nose and throat normally present.

Natural Immunity.—As previously mentioned, every infectious disease is the result of a struggle between two variable conditions: the pathogenic powers of the bacteria on the one hand and the resistance of the invaded subject on the other. These, of course, are modified by the conditions under which the struggle takes place. Micro-organisms may cause a sudden and fatal disease in one person but be absolutely innocuous to another. The susceptibility or resistance of an individual may be determined, to a great extent, by the physiologic state or the conditions under which the invader and the invaded are brought together. Immunity, then, deals with an analysis of the variables. The inheritance of immunity has been questioned, but a study of families and races leads us to believe that the inheritance of resistance is much more than a myth. Thus, in Mexico, smallpox is known only as a mild disease. Again, the colored race does not seem to be so susceptible to yellowfever as is the white. It has been suggested that in addition to inherited cell characteristics, antibodies may pass from the mother to the offspring through the placental circulation.

It is a matter of common knowledge that there are certain diseases which attack a person only once, such as smallpox. When a person becomes infected with smallpox virus, certain resistant substances, called antibodies, are manufactured in the invaded body and the ability to manufacture these substances is usually retained throughout life. This is known as acquired immunity.

Antibodies taken from the blood of a freshly and actively immunized animal may be injected into the blood stream of the susceptible animal and confer immunity on the susceptible animal. This is called passive immunization. Following the active immunization of an animal is an actual production of heat resistant antibodies. Substances by use of which antibody formation may be induced are collectively spoken of as antigens. According to Zinsser, antigens are all substances which, injected into the animal body, cause specific antibody formation. Chemically, they are known as proteins, and it is a fact that all known complete proteins may act as antigens. Injection of an antigen into an animal body produces a specific and definite antibody which will combine only with the antigen originally injected. The tissue cells may be looked on as the source from which the various protective constituents of normal and immune serums originate. The exact location of the antibody-forming cells in tissues is not at all clear at this time.

In the resistance of the body to invasion of micro-organisms, the blood plays an important part. As early as 1792, John Hunter had noted that blood did not decompose so readily as other material and, a century later, the opinion was expressed that blood could destroy micro-organisms. In 1866, Nuttall definitely measured the destructive influence of blood on bacteria. This power of the blood to kill bacteria is weakened on standing and is rapidly destroyed by heating to 60° C. The antibacterial power of blood depends on a constituent of the fresh blood plasma which has been named alexin, or complement. Alexin is generally considered potent against all bacteria equally without showing a specific selection for various species to any great extent.

We have learned that in the immunization of an animal, there occurs within its body the production of a preventive substance moderately resistant to heat and a specific for the bacteria or antigen employed in the immunization. This substance cannot act on the bacteria alone, but depends for its effectiveness on the cooperation of other substances universally present in normal serum. The bactericidal substance, which is nonspecific, corresponds to alexin and is apparently not increased by the process of immunization.

Phagocytosis, or cell ingestion, as a mode of protection against bacterial invasion cannot be disregarded in a study of this type, and, last but not least, the saliva must be considered an important factor in the oral defensive mechanism.

The prevention and control of any infectious disease must be based on an understanding of the variable factors, which have been briefly presented. As with all other infections, the presence, extent and severity of gingival infection will be determined by two variable conditions, the competency of the defensive mechanism on the one hand and the quantitative virulence coefficient of the invading micro-organisms on the other.

In order that rational methods of prevention and control may be instituted against gingival infection, it is necessary that cognizance be taken by the operator of the variable factors of all infectious disease processes.

The modern physiologic concept of disease is clearly stated by Noyes in the introduction to his excellent text on dental histology:

The development in knowledge of the cell has had a most profound effect upon the entire practice of medicine; in fact, the progress of modern medicine has dated from the studies of cell biology; the germ theory of disease being only one of the phases of this development. In terms of the cell theory the functions of the body are but the manifest expression of the activities of thousands or millions of more or less independent but correlated centers of activity. If these centers or cells perform their functions correctly, the functions of the body are normal but if they fail to perform their office or work abnormally, the functions of the body are perverted. In the last analysis, then, all physiology is cell physiology, all pathology, cell pathology. To modern medicine, histology, or the cell structure of the organs and tissues of the body, together with cell physiology, is the rational foundation of all practice.

SUMMARY

This presentation is, admittedly, an inadequate and abbreviated discussion of some of the factors in the problem of infectious disease. After a consideration of all known factors, it is still our opinion that the majority of the cases of persistent gingivitis are the expression of a specific bacterial disease. Owing, then, to the variation in the resistance, particularly in the local defensive mechanism, the average case of chronic fusospirochetal infection is characterized by periodic mild to acute reactions which strike here and there throughout the mouth until practically every interdental space is involved and a generalized gingivitis is established. In spite of the protean manifestations of this disease, the gingivae and soft tissue reaction is remarkably constant, and it is impossible to tell from the appearance of the gum the nature of the resistance-lowering factor. Grossly and microscopically, the persistent gingivitis of pregnancy, dietary deficiency, diabetes, etc., is identical, this signifying the essential unity of their etiology. Generally speaking, the two most important causes of lowered gingival resistance are hygienic neglect and an abnormal dietary.

There is considerable debate as to which is the more important in the production and maintenance of chronic gingival disease and which comes first, the predisposing factors or the bacterial activity. Such debate is futile. Both are essential, and it is doubtful whether the relatively avirulent types of bacteria would ever be able to initiate disease in perfectly normal gingival tissue.

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THE RÔLE OF CROWN AND BRIDGE PROSTHESIS IN THE FIELD OF RESTORATIVE DENTISTRY

By Arthur O. Klaffenbach, D.D.S., F.A.C.D., Iowa City, Iowa

AMONG the most ancient relics of early civilization are artificial teeth with ingenious contrivances to hold them in place. There is evidence that the Egyptians and Hindus replaced lost teeth by attaching wood or ivory substitutes to adjacent sound teeth by means of threads or wires. History and archeology reveal that ancient princesses, more than a thousand years ago, patrician matrons of the Roman Empire and the ladies of the middle ages all submitted to long and difficult operations, under primitive conditions, and with incredibly crude instruments, in an attempt to restore the charms ravaged by caries and the loss of teeth. Some of these ancient dental restorations were beautifully designed and artfully wrought. But for all its amazing workmanship, dentistry was essentially handicraft—the work of the mechanic or craftsman—more closely associated with the art of the jeweler.

The somewhat belated development of the present biologic concept in restorative dentistry may be attributed to those pioneer master minds who saw beyond the missing teeth to be restored or the crowns of the teeth on which they worked, and realized that the mechanical aspect of dental practice was only one phase, and that it lacked coordination with biologic and physiologic laws. As a result of the convincing evidence submitted by these pioneers, the dental profession must assume greater responsibility in safeguarding the health of the patient, rendering a health and preventive service in addition to those of restoration and esthetics.

Health is dependent, in an unusual degree, on the proper adjustment or relations of a great many interdependent actions of the body. The heart beat, respiration, metabolism, digestion, elimination are all of vital importance to the smooth and efficient working of the body. We need but recall that every modern machine, from the power engine to the loom, from the modern printing press to the watch, is equipped with numberless automatically working devices of fine control and sensitive adjustment. To the barbarians, these man-made machines are as wonderful and complex, because not understood, as are the marvelously fine and sensitive powers of adjustment of living organisms to us, who still have much to learn about them.

With the realization of the importance of this interdependence and relationship of the component parts of the body, it at once becomes apparent that the oral cavity, situated at the opening of the alimentary canal, with its organs of mastication, plays a most important and significant part in the maintenance of health and prevention of disease and must be considered as a unit of this intricate machine, the human body, made up of interdependent and correlated parts.

DENTAL CRIPPLES

Every patient who has lost one or more

(Read before the Section on Partial Denture Prosthesis at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

teeth, with the possible exception of the third molars, may be rightly regarded as a "dental cripple." Even the loss of a single tooth, to a certain extent, impairs the function of that mouth and is the beginning of a vicious circle of oral disease, unless replaced by a restoration which fulfils the biologic and physiologic requirements.

The lack of unity of the teeth and arches following the loss of a tooth or teeth, especially in the posterior region, ultimately results in occlusal disharmony, and pathologic involvement. These, together with the changed relationship of the mandible to the maxilla and the temporomandibular joints and the loss of vertical dimensions and facial contour, are in the aggregate conditions that are not generally considered contributing factors in the condition of the "dental cripple," which could have been prevented by early restorative procedures.

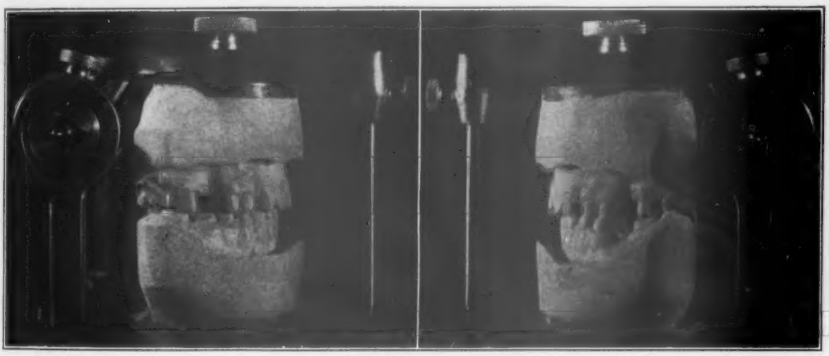

Fig. 1.—Case with three first molar teeth missing. The incisal edges of the lower anterior teeth contact the linguogingival tissue of the upper anterior region. Opening the bite was accomplished with three fixed bridge restorations and onlays on the bicuspid teeth.

FIXED OR REMOVABLE RESTORATIONS

How best to replace missing teeth, prior to and after certain progressive pathologic changes, is a problem which rightly falls within the scope of this paper. The replacement of lost teeth demands a thorough examination, an understanding of occlusion, a complete diagnosis and a carefully formulated plan of treatment that will conserve the dental organs and units of the apparatus of mastication, and render a health, preventive, restorative and esthetic service.

It is not my intention to enter into a lengthy controversial discussion relative to the merits or demerits of the fixed and removable types of restoration. Individual skill, and other factors, may result in some operators giving preference to one type, but it is doubtful whether any one type will afford the extended range of possibilities resulting from an equitable intelligent use of both types.

It has been my observation that even though new technics and methods of procedure have been applied to removable bridge restorations, and many methods of attachment and support have been exceedingly ingenious from the mechanical and engineering standpoint, there is, in actual use, a tendency for them to develop the principle of the lever, comparable to that of orthodontic appliances but without controlled forces. This finally results in failure because the physiologic and biologic demands of the abutment teeth and supporting tissues have been violated.

Extensive clinical observation and a careful study of clinical records have con-

vinced me that there is no type of restoration for the majority of short span edentulous spaces so efficient and satisfactory, giving service over a longer period of time, as the fixed bridge, when used where indicated and when properly designed and constructed.

Consideration of those cases in which the abutment teeth are healthy and sound may frequently result in a plan of treatment calling for the removable bridge; more especially if the patient is young, or the teeth not fully calcified, when a decision must be made in favor of the removable bridge or space maintainer. Since most posterior teeth used for abutments are more or less carious, or have been restored with fillings or crowns, the preparation of such teeth may be carried out without further hesitation, provided they are vital and without pulp involvement. The use of sound anterior teeth quite frequently necessitates choosing the lesser of two evils. The fact that anterior removable bridges in the majority of cases, have not proved satisfactory, and esthetically are generally undesirable because of unsightly clasps or attachments, or saddles, has frequently led to a plan of treatment in favor of the fixed bridge. However, where the restoration of missing posterior teeth and anterior teeth is necessary in the same arch, with sound teeth and favorable ridges, a correctly designed and constructed removable appliance may suffice.

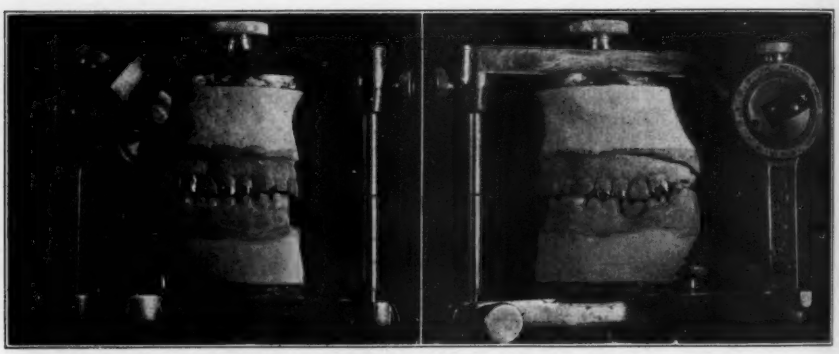

Fig. 2.—Centric occlusion.

OCCLUSION

Periodontists were the first in the profession to give careful consideration to traumatic occlusion and to recognize the possible magnitude of the pathologic consequences of occlusal trauma. This matter of establishing functional occlusion prior to making a bridge restoration and building into it and maintaining the proper occlusal balance is of major importance; but, unfortunately, in numerous instances, its importance is partially or entirely overlooked or disregarded.

The treatment of cases wherein teeth have been lost and occlusal disharmony exists should include the treatment of periodontal lesions; the grinding of teeth, if necessary to establish functional occlusion; the elimination of excessive stress on the teeth used as abutments, and the replacement of missing teeth with prostheses functioning in harmony with the previously established functional occlusion.

If your automobile idles too fast and this interferes with the proper shifting of gears, you may be able to improve the condition by cutting off a few spark plug wires; but you would never approach the problem in this way if you were at all familiar with the underlying principles of

the mechanism. Similarly, the grinding of teeth may be done injudiciously or indiscriminately, which may or may not improve the existing conditions; but the full benefits to be derived from grinding cannot be secured, nor is grinding deemed advisable, unless the underlying principles of occlusion are fully understood.

Regarding the importance of correctly grinding teeth, permit me to quote from an article on this subject by Clyde H. Schuyler[1]:

> Grinding of both natural and artificial teeth has been done by most operators in a ruthless, haphazard manner. Some have advocated the use of abrasive pastes as the most desirable means of creating occlusal harmony.

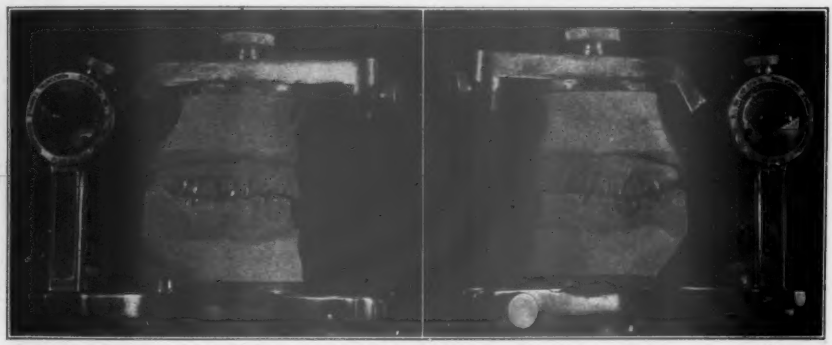

Fig. 3.—Right lateral occlusion.

These procedures have resulted in reduced sharpness of cutting cusps, elimination of food exits and increase in contact surfaces; all of which render the teeth less efficient in function and necessitate the application of excessive forces.

The milling away of the supporting cusp points permits a closing of the maxillomandibular relation and may result in an uneven distribution of stress in either centric or eccentric occlusal positions.

CLOSED BITE CONDITIONS

Premature loss of deciduous posterior teeth or the loss of permanent posterior teeth, especially during early life, is frequently responsible for closed bite or deep overbite conditions. For such cases, the plan of treatment for replacing the missing teeth should, where conditions are favorable, include opening the bite and repositioning the mandible. The etiology of such cases should not be confused with that of those in which the heads of the condyles are resting in their normal position in the glenoid fossae or in which the deep overbite is due to lack of vertical growth in the posterior region, excessive vertical growth in the anterior region or a combination of the two. Furthermore, treatment of the adult closed bite resulting from the loss of teeth must be different from the treatment of deep bite before maturity. This differentiation between the case of the adult and that of the child or younger patient is of paramount importance.

It is my opinion that satisfactory results cannot be obtained by reconditioning in patients under 20 years of age because of the ease with which teeth can be moved, intruded or extruded. Such cases had best be referred to the orthodontist for treatment. For patients not more than 30 years of age, or in whom there is still a possibility of intrusion of the posterior teeth under pressure, varying degrees of adult orthodontic adjustment combined with a reasonable reconditioning treatment would be advisable. When adult orthodontic treatment is instituted, movement must be accomplished

slowly and judiciously, as otherwise failure, as evidenced by absorption, loss of teeth and disease, will result. When the patient has reached middle age or beyond and the existing closed bite condition has produced occlusal trauma, tooth abrasion, deep bite, loss of the temporomandibular relationship or diminished vertical dimension with its accompanying change in facial contour, opening the bite by restorative procedures affords a compromise treatment. Although opening the bite does involve considerably more planning and a more exacting technical procedure with added expense to the patient, it should always be considered and the patient be informed as to the possibilities and the benefits to be derived therefrom, before restoration of the missing teeth.

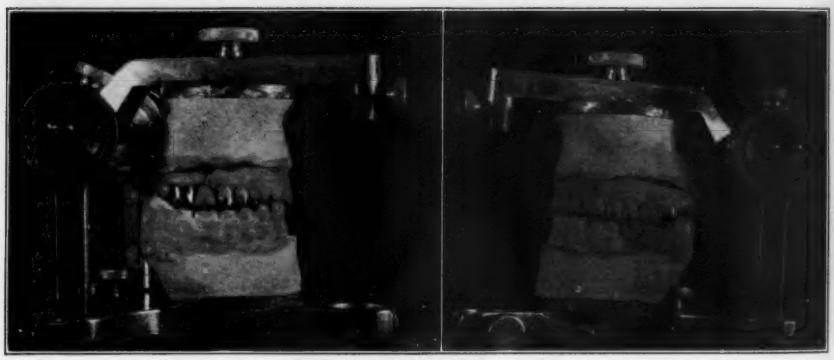

Fig. 4.—Protrusive occlusion.

TEMPOROMANDIBULAR ARTICULATION

A careful study of the temporomandibular joint by means of roentgenograms aids materially in determining the relative position of the head of the condyle to the glenoid fossa. Since such roentgenograms can now be obtained by means of an apparatus with head positioner and casette, the correct angulation can be secured and duplicated at any time. However, because of the various anatomic structures which lie in the path or the area involved, it is at times difficult to obtain distinct, shadowless roentgenograms of the temporomandibular region.

Appreciation of the fact that this joint is often an important etiologic factor in closed bite cases leads to correct repositioning of the head of the condyle. When the condyle head has moved backward and upward, owing to abnormal occlusion resulting from the loss of occlusal relationship of the maxillary and the mandibular teeth, causing a closed bite condition, care must be taken in repositioning and establishing the new height of bite that the physical rest position does not encroach too closely on the physiologic rest position of the mandible. When the bite is opened too much, the patient will feel uncomfortable and is apt to become nervous and irritable owing to the unnatural condition established. The decrease in space between the physical and physiologic rest positions thus produced causes muscle fatigue and other unnatural and unfavorable conditions.

SPLINTS

While there are some objections to the use of splints, their use is frequently justified as a preliminary measure in opening the bite and repositioning the mandible. If splints are carefully constructed of a suitable gold alloy so that functional oc-

clusion is established in all ranges of the mandible, the interproximal spaces left open and proper prophylactic measures instituted, the patient should experience no particular inconvenience or detrimental effects from them.

Splints provide a means for checking the operator's diagnosis and plan of treatment, aid in acquainting the patient with the new bite and afford a means of prognosis. Later, they can be used as a protection for the prepared teeth, or they can be removed in sections as the work of restoration proceeds.

Any procedure as extensive and intricate as this is certain to result in the development of numerous methods, in differences of opinion and in disappointments based on a correct comprehension of this complicated restorative procedure. In any science or procedure, time must elapse before a sufficient background of facts can develop to permit a logical appraisal of the situation; which is indispensable to formulation of basic principles. While considerable progress has been made, it is quite important that we proceed with caution, carefully considering our failures as well as our successes, and thus avoiding faulty conclusions and unjust condemnation from the wave of "bite raising" enthusiasm at present being manifested by the dental profession.

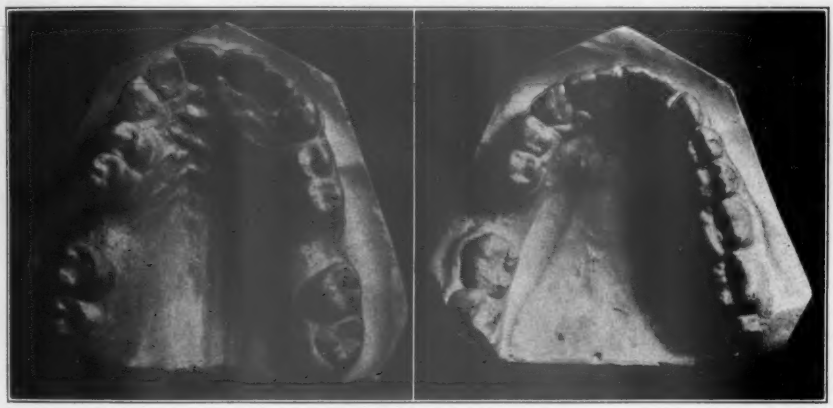

Fig. 5.—Occlusal view of case before restoration and opening of bite.

DEGENERATIVE CHANGES IN THE TEMPOROMANDIBULAR ARTICULATION

Degenerative changes in the temporomandibular articulation resulting from the loss of teeth on one side has been recognized by Cryer,[2] Prentiss,[3] House[4] and others. With a partial or complete shifting of function to one side of the mouth, the muscles of mastication become more powerful. In turn, the pressure on the head of the condyle against the meniscus increases, bringing about a change in form in one or both fossae. Unilateral function, since it changes the form and increases function, must be prevented by replacing the missing teeth, as otherwise the dentist and the patient will both encounter difficulties should the patient ever need bilateral partial or full dentures.

RESTORATION FOLLOWING EXTRACTION

Extraction of teeth is a necessity in every dental practice to eliminate acute, chronic or potential infection; or for other reasons. But how many dentists take the time to discuss with their patients the degenerative changes that follow if the edentulous spaces resulting

from such extractions are not filled? Few patients realize the real harm that follows, for example, failure to supply an extracted lower first molar tooth. The loss of contact points, tipping and extrusion of teeth, loss of occlusal harmony and unity of the arches and lack of physiologic stimulation to the soft and osseous tissues due to changed relationship and misdirected stresses are all causative factors, ultimately bringing about destructive pathologic changes in the apparatus of mastication and temporomandibular joint, varying in intensity in proportion to the age of the patient and the length of time that elapses after extraction. If the operator does not inform his patient of the health, preventive and other benefits to be derived from the restoration of these edentulous areas, he has not fulfilled his duty to his patient.

Fig. 6.—Occlusal view of case after restoration and opening of bite.

ABUTMENT TEETH

The vitality, condition of the investing tissues, degree of support and condition of the crown of the tooth require due consideration in the selection, diagnosis and treatment of the abutment tooth.

A sound, vital tooth of at least medium length provides the best type of abutment tooth. The pulpless tooth should always be considered a potential source of infection and its use is not advised.

The soft investing tissues must be in a state of health. Otherwise, proper treatment must be instituted and precautions taken to prevent recurrence of any pathologic conditions.

The alveolodental tissues must afford support consistent with the stresses that will be imposed on it. Nature has provided all teeth with an additional margin of safety, which must not be exceeded if pathologic conditions are to be avoided. The abutment tooth that is inadequately supported owing to lack of alveolar support from absorption or demineralization must be used with due consideration.

The biting stress exerted by patients varies considerably. Relative poundage exerted by the patient can be measured with a gnathodynamometer. In my judgment,[5] there are certain fundamentals in tooth restoration that seem to be entirely overlooked, and an intelligent conception of such fundamentals as functional capacity, overload and margin of safety cannot be appreciated unless we learn first the actual forces required to masticate properly the various articles of diet and how these fundamentals are affected or restricted by such restorations.

ABUTMENT OR ATTACHMENTS

The length, size and form of the abutment tooth; size and location of the

pulp; extent of caries; degree of susceptibility or immunity to caries; degree of osseous support; condition of the investing tissues; location in the arch; length of span and stresses encountered; the alinement (tipped or parallel), and the esthetic requirements are some of the more important factors in determining the type of abutment.

Fixed bridge abutments may, for convenience, be placed in three general groups: (1) the intra-oral, such as the inlay, which fits into a cavity prepared in the abutment tooth; (2) the extra-oral, such as the full cast crown, which fits over the prepared tooth, and (3) a composite, which utilizes both principles of the extra-oral and intra-oral types, such as the three-quarter or partial crown. These three groups supply an adequate range, but, at times, owing to the wide variations and conditions of the abutment teeth, require modification, the success of which is dependent on the ingenuity and ability of the operator to meet the requirements of retention and prevention. Sane, sound judgment and a sense of the biologic and physiologic relations, together with the mechanics involved, are essential in the designing and construction of abutments.

Fig. 7.—Extreme case of abrasion which required one bridge restoration, crowns and onlays to open bite and restore functional occlusion. Four porcelain jacket crowns were used on the upper anterior teeth. All teeth are vital.

The possibilities of the modern full cast gold crown and the many failures of inlay abutments have resulted in the more frequent use of the partial or full cast gold crown as an abutment for posterior teeth. The argument often advanced is: "Since the cast gold crown is so retentive and satisfactory, why not use it as a specific abutment on all molar teeth?" Such practice would, indeed, be very fallacious; for where the abutment teeth are strong and of ample size and length, an adequate cavity can be prepared and a cast abutment inlay or partial crown be made to meet the demands imposed on it. If, after a period of years, the abutment tooth should be attacked by caries to the extent that it cannot again be restored with a similar or a more extensive casting, the cast gold crown can be used. By such a procedure, the life of the abutment tooth will be materially lengthened.

The utilization of extensively decayed or badly broken down bicuspid teeth for abutments presents a difficult problem because of the esthetic values involved. Unfortunately, many of these teeth have thin, frail buccal and lingual walls with little or no supporting dentin. A thimble jacket crown cannot be used, since the remaining tooth substance would be lost in making the preparation. If the walls are strong enough, the cusps may be capped or protected. Where the lingual wall has sufficient strength, a core or base can be made, without devitalization, and a gold crown with a porcelain facing or veneer be constructed.

On anterior teeth, the three-quarter or partial crown will usually suffice, but this type is not by any means universal in its application. In numerous instances, the operator will require ability and ingenuity to produce a retentive and esthetic abutment. Although I do not sanction the wilful mutilation of sound abutment teeth, it is, in my opinion, justifiable in some cases. However, before this is done, all other means of restoration must be carefully considered as to prognosis and serviceability.

RETENTION

Lack of retention is in numerous instances the direct cause of failure of fixed bridge restorations. The desire to conceal the gold and thus enhance the esthetic value of the restoration has often influenced the operator to minimize the size and extension of the abutment to such a degree that it does not have sufficient retention to withstand the stresses imposed on it. Conservation of tooth structure is very commendable, but it must be done within reason. Small, thin inadequate abutments, which from the esthetic standpoint are very desirable, lack stability, strength and retention and soon loosen, and the abutment teeth are attacked by caries, which progresses very rapidly beneath the abutment and, if not discovered, soon involves the pulp.

the cusps of the posterior teeth during lateral excursions of the mandible. The dislodging tendencies of these stresses, together with the torsional stress, must be overcome with correct occlusion and carefully prepared cavities with flat seats, parallel walls, adequate extension and definite point and line angles.

Not only must extreme care be exercised in the preparation of the abutment tooth, but also the gold alloy casting must fit against these seats and walls and into these angles without undue compression of the dentin, in order to obtain the full measure of retention made available by correct tooth preparation.

EXTENSION FOR PREVENTION

For esthetic reasons, extension for prevention on anterior teeth should be very

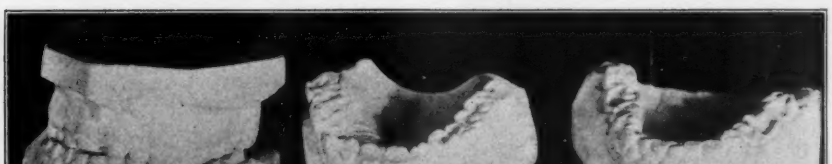

Fig. 8.—Casts of case shown in Figure 7.

To have adequate retention, an abutment must be so prepared that it will resist the stress imposed on it. Overestimation and misplaced confidence in the ability of cement to retain attachments have frequently been the cause for condemning certain types of abutments which, had they been accurately constructed, with sufficient retention, would have been satisfactory.

The stress of mastication includes the compressive stress, which is used in crushing and grinding food; the tensile stress, which tends to pull the appliance from the abutment tooth in chewing sticky food, candy or gum, and the shearing stress, produced by the incisor teeth and

limited, especially where one is assured that the patient will give the bridge the proper prophylactic care. In the bicuspid region, the mesiolingual and the distal extensions should be increased. In the molar region, sufficient extension for prevention and pontic clearance must be provided for marginal protection. All margins should lie within immune areas and be accessible to the cleansing action of food massage, the toothbrush and dental floss.

PONTICS

The modern porcelain tipped pontic with highly glazed gingival areas and gold alloy lingual and occlusal surfaces

supersedes all other types of pontics where the space gingivoclusally or incisally is long enough to permit its use.

The gingival portion may take the form of a small saddle or a tip. An unbroken lingual contour prevents the lodgment of food. Its lingual and proximal gold and porcelain surfaces are convex and as accessible to the toothbrush as are the natural teeth. In the anterior region, the saddle type is generally the one chosen, for it has greater esthetic possibilities. In the posterior region, the rounded tapering tip and enlarged interproximal spaces make it a simple matter for the patient to use dental floss and rinse the mouth. Interproximal spaces should not be enlarged for anterior pontics. Since the soft tissue will not fill in these spaces, utterance of articulate sounds may be affected and, in some instances, a slight whistling or lisping may result. Furthermore, the typal tooth form of the facing is changed, which esthetically produces an inharmonious or artificial appearance.

All tips or saddles should, without pressure, just contact the mucosa of a completely healed ridge. Placement immediately following extraction is not recommended, and when the occasion demands, the bridge should be set temporarily with zinc oxide and eugenol so that adjustment of the tip or saddle can be made after the ridge has completely healed.

During construction, a paster of Paris or modeling compound core should be used to hold the facing or facings in definite relation to the ridge so that the saddles or tips will be shaped to fit the ridge accurately at that particular location while the occlusal and lingual portions are being developed and to hold the pontics in their correct positions when they are being assembled prior to soldering.

Anterior pontics should be so formed that the bulky portion of the lingual convexity is not in the middle third of the lingual surface. In order to prevent tongue annoyance and phonetic interference from this, the pontic should have its thickest area in the gingival third, conforming as nearly as possible to the cingula of the natural teeth.

The occlusal surfaces of all posterior pontics must be so formed that functional occlusion will exist. The cheek, tongue or lips must be protected from injury by the proper axial relationship. All marginal ridges must be opened with grooves to relieve stress and to permit massage of the underlying tissues during the process of mastication. The cusps, grooves, sulci, etc., characteristic to the individual have a definite function to perform and should be incorporated in the pontic construction.

The practice of placing porcelain tip or saddle pontics of ground unglazed porcelain in contact with the mucosa of the ridge immediately defeats the purpose of this type of pontic. Ground unglazed porcelain cannot be kept clean. It is unhygienic because of the adherence of saliva, mucin and slimy food débris to the ground surface of the porcelain. Being unglazed, the porcelain is porous and absorbs saliva, even though polished with abrasives such as tin oxide or porcelain polish.

If all our cases provided sufficient axial length, the porcelain tip or saddle type of pontic would be almost universal in its application. Unfortunately, we have those cases wherein the space is too short to permit the use of a gold-porcelain pontic. For such cases, the all gold occlusal platform has been suggested. It is, however, a known fact that any gold alloy, even though it is highly polished, will become coated with a foul adherent mucinous mass which, after a time, will resist removal. Consequently, it becomes unhygienic and, if in contact with the tissues, becomes a source of irritation.

ESTHETICS

"The entire esthetic problem resolves

itself around the thought of harmony between the restoration and the individual. Any restoration is esthetic in proportion to its ability to conceal itself."

How many times have we seen anterior restorations which, because of form, shade and arrangement of the pontics, have detracted rather than added to the personal appearance of the patient. "No art can survive the handicap of poorly matched or unnaturally shaded teeth, ill-formed, and incorrectly arranged. No art can compete against such odds with any hope of success."

MODIFYING FACINGS

Since all the newer molds of facings now available closely resemble the ideal in form, it is at times necessary to modify or reshape them to harmonize with the patient's natural teeth and face form, to conform with them in size or to reproduce conditions due to wear. When a facing must be altered, one should be selected that will require the minimum amount of grinding to make it harmonize with the natural teeth. It is perhaps needless to say that all such ground facings must be reglazed.

Occasionally, we encounter a case in which the edentulous space is too wide for one and not wide enough for two facings. This condition can sometimes be met by reshaping a molar facing to conform in shape with the two bicuspid facings desired, such as where two narrow upper bicuspid pontics are needed. Two narrow lower central incisors may also be supplied by utilizing a large central incisor facing and grinding it to the shape of two central incisors.

CHANGING SHADES OR STAINING

In order to have porcelain pontics match the natural teeth, changing the color or staining stock facings becomes necessary. At times, it is impossible to obtain facings of the proper shade; or the original color distribution may have been changed by grinding to the desired form or in shortening the gingival portion in order to have the pins in the most favorable position.

Change in color of the facing may be accomplished either by grinding away a portion of the facing and rebuilding it with porcelain of the desired shades, or by staining. A change in color will usually call for rebuilding. When this is done, one must know that the thickness of the layer of porcelain added and the color of the underlying porcelain will change the shade of the finished product. Porcelain stains are used to intensify the color of the original porcelain or to imitate thin translucent incisal edges, tobacco stains, decalcified areas, enamel checks or similar defects. Staining must be artfully done, as otherwise the purpose for which stains have been applied will be defeated by an unnatural appearance. Pink porcelain can be used to advantage where there has been considerable resorption or loss of tissue, by careful blending of the pink porcelain with yellow, blue, white, etc., to conform with the shade of the natural gum tissue.

ASSEMBLYING

With the cast gold alloy abutments fitted accurately, paralleled with each other and adjusted to functional occlusion, we are ready to orient them to the working cast. To obtain such working casts requires precision in every detail so that the abutments will be in correct relationship to each other and the opposing cast when mounted on an anatomic articulator. Inaccuracies in this procedure have too often resulted in grave errors, such as failure of the prosthesis to go to place, faulty occlusion, a strained condition of the abutment teeth or the presence of open margins due to failure to seat the abutments properly.

The buccal or labial core used in developing the wax patterns for the pontics is employed for assemblying the pontics on the cast. With metal contacts between

the pontics and abutments, it is a simple matter to wax them together. The wax should occupy only the space or area to be occupied by the solder. This will prevent the soldering investment from filling in the area desired for solder and also prevent the solder from flowing into undesirable areas or over margins.

SOLDERING

It is essential that soldering be done without shrinkage or distortion of the assembled prosthesis. The cast gold portions of the pontics and the abutments of the modern fixed bridge should be united with a high-grade, strong solder. The joint should be in the region of the contact point and so shaped that this area can be readily cleansed. Solder joints too long gingivoclusally fill in the interproximal spaces, or encroach on the septal tissues. Those too wide buccolingually increase the occlusal area and consequently increase the stress on the abutment teeth owing to the elimination of the buccal and lingual embrasures and an increase in the occlusal area.

With the exception of the contraction of the soldering investment, the only shrinkage that can possibly take place is that resulting from the use of a thin film of solder to join each unit of the bridge. This shrinkage is so slight in modern bridge construction that it is practically nil and should not be compared to the contraction which resulted when the backings, abutments and cusps were united and the entire body of the old type bridge was built up at the same time with solder. Since our newer soldering investments have been perfected, the possibility of shrinkage or distortion, if manipulation is in accordance with directions, is practically eliminated.

Where two pontics are adjacent to each other, they may be cast as a unit, one solder joint being thereby eliminated. Bridges with one pontic may be soldered directly on the soldering investment cast or one end left unsoldered, after which it is assembled in the mouth, a shallow impression taken and the other joint soldered, after being carefully invested. For those cases with several pontics and abutments, sectional soldering may be resorted to and the sections finally assembled on the working cast or in the mouth, any shrinkage or distortion that might occur from soldering such long spans all at one time being thereby avoided.

STRENGTH OF SOLDER JOINT

The four conditions determining the strength of a solder joint are: 1. The physical properties of the solder used. Low-grade inferior solders are brittle and are not easily manipulated. 2. The degree that the surface gold in the pontics or abutments has been alloyed during the soldering process. To have strong joints, surface alloying must be avoided by soldering as rapidly as possible with a minimum amount of heat. 3. Elimination of flux. The presence of any flux in a joint materially weakens it. 4. Size, thickness or bulk of a solder joint. Solder joints should be as thin mesiodistally as possible. It is interesting to note that a solder joint 3 mm. thick is capable of withstanding about 45,000 pounds pressure per square inch, whereas a solder joint 1 mm. thick will withstand a pressure of about 110,000 pounds per square inch, provided there has been no surface alloying.

CORRECTION OF MISFITS

Some completed bridges, when tried in the mouth, fail to go to place without (1) undue pressure or (2) displacement of the abutment teeth. Permitting the patient to wear such a misfit with the hopes that the abutment teeth will adjust themselves to the desired position is not consistent with good practice. When discrepancies in fit occur, the abutment or abutments should be unsoldered from the pontics and readjusted directly in the mouth. The pontics and abutments being

securely waxed together in correct position, a shallow plaster impression is taken in which the units are placed, invested and resoldered.

It is best to unsolder the joints rather than cut them apart. This can be done over a Bunsen burner or with a blowpipe flame. Separating joints with a carborundum disk or a mechanical saw always widens the space. This widening of the space is objectionable because it widens the solder joint; which increases the possibilities for shrinkage, with the result that more gold may show from the buccal or lingual aspect.

CONCLUSION

Every crown and bridge requires a periodic examination, a meticulous adjustment of occlusion, cooperation of the patient and the necessary maintenance in order that the success of the restoration may be assured.

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MOVEMENTS AND POSITIONAL RELATIONS OF THE MANDIBLE

By Harry E. Denen, D.D.S., Chicago, Ill.

IT is the intention to present here the findings, in part, of a group of men, who were interested solely in the progress of the work undertaken. It was believed that to bring to an audience of practicing dentists a wholly scientific and too technical discussion of the theoretical evolvement of this subject would neither lend to cooperative understanding nor assist us in gaining your aid in further research. We have, therefore, concretely summarized our theoretical findings, and after working them out in practice, submit them to you. Our enthusiasm about the subject is merely a reflection of the success we have attained in applying the theoretical to the practical.

(Read before the Section on Partial Denture Prosthesis at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 14, 1937.)

HISTORY

Much work has been done in the past seventy-five years or more in the study of jaw relations and movements, and credit must be given to the pioneer investigators. Time does not permit an elaboration of the individual work of these men. Suffice it to say that the basic findings and fundamental principles of some of their work and discoveries are incorporated in our work. Regardless of the differences in opinion that some of these investigators may have had, there were certain basic principles which all agreed to and accepted as consistent in the findings of their various investigations.

IMPORTANCE OF ESTABLISHING THE VERTICAL DIMENSION

The establishment of the vertical dimension is the first consideration in all types of restorative dentistry, whether it be full mouth reconstruction with inlays, fillings, crowns and bridges or partial or full dentures.

We are well aware of the disastrous effects direct or indirect of a change in the vertical dimension, such as (1) ear and sinus disturbances; (2) loss of muscle efficiency for mastication; (3) impairment of the health of the teeth and their investing structures, all emphasizing the necessity of establishing and maintaining a correct bite.

CENTRIC RELATION OF THE MANDIBLE

Relating the mandible to the maxilla in its centric position is governed by two registrations, one for the vertical relation and one for the horizontal relation. Vertical centric relation means the anatomic balance of the mandible vertically; horizontal centric, the anatomic balance of the mandible horizontally.

Vertical centric relation can be determined with a measuring scale or guide that will record anatomic measurements of the profile. Dr. Sorenson, of Fond du Lac, Wis., has devised a scale that has proved quite satisfactory in our hands. It contacts the face at two points: the bridge of the nose and underneath the tip of the chin. The scale is calibrated in millimeters. Readings on it are taken from the bridge of the nose to the root of the nose and from the bridge of the nose to the length of the upper lip in repose. These two measurements added together equal the approximate distance from the bridge of the nose to the tip of the chin in normal profile.

These measurements are quite reliable and establish, in the majority of cases, the normal vertical centric relation of the mandible. Anatomic facial harmony is found in normal faces where forehead, nose and chin are equal in vertical dimensions. Measurement of a large number of faces shows this balance to be present in the majority.

As against these measurements, we examine the case for occlusal clearance with bite occlusion rims to guide us in our observations. Regardless of measurements of any kind whatsoever, we determine and accept only a vertical relation (dimension) that presents approximately a one-eighth inch space between the bite rims at the incisor point when the mandible is in repose. This is true to nature and is required to assure muscle balance and muscle efficiency as well as comfort to the patient.

Horizontal centric relation is obtained with central bearing plates and a tracing pin to record a gothic arch tracing on a graph plate.

There has been much discussion about registering horizontal centric relation. Many investigators state that this position is correct *only* when the mandible is in its most retruded position. We take exception to this premise because we have definitely proved that the most retruded position of the mandible is a strained position and that the patient will not submit to the punishment of being placed in this position.

To analyze this statement, I relate some of our experiments. In full denture cases, central bearing registration plates and a graph plate were used. With a tracing pin and the graph plate outside the mouth, the customary gothic arch was traced by the patient, who was then questioned as to whether he was comfortable or uncomfortable when holding the mandible in the apex of the gothic arch. As a rule, the answer was "uncomfortable." The patient was then asked to open and close several times in the position in which he felt comfortable. It was observed, then, that the tracing pin was back of the apex (mandible forward). The difference in distance between the apex and this comfortable point, while slight, is sufficient to spell

the difference between comfort and discomfort.

Many men use the intra-oral method of registering a gothic arch tracing. By this method, when the gothic arch is traced on the graph plate, a hole is punched at the apex and the patient is requested to move the mandible until the central bearing pin drops into the hole. We must not forget that denture bases are not rooted to the jaws, and when locked in a definite position, the mandible, if not in a comfortable position, can ease forward underneath the denture base sufficiently to assume a comfortable position. Unless cognizance is taken of this important fact, those who employ this method will be misled. The thought prevails that because the tracing pin rested in the hole punched at the apex, the mandible was in its most retruded position; whereas, in reality, the jaw had moved underneath the base and consequently the registration of the position of the apex was false.

Our next experiment was made to check up on this interesting finding. Central bearing plates were made to fit our own natural teeth in such a manner as not to interfere with the occlusion of the teeth. One was fitted to the maxillary arch with a pointed screw in the center of the plate to act as a stylus. The other was fitted to the mandibular teeth and carried a thin metal registration disk. With the bearing point holding the teeth slightly out of occlusion, a gothic arch tracing was made. At the apex of the tracing, a very fine point was punched. The mandible was then directed to this point and held in the position determined by the apex. Here, the mandible could not move as in edentulous mouths with denture bases, because of the teeth which are fixed in the bone. In no case tested to date with this method have we found the apex to be other than a strained, uncomfortable position. To those of you who believe the apex of the gothic arch, which is the most retruded position of the mandible, to be centric relation of the mandible, we insist that you make this experiment in your own mouth.

Two cases were also made for an edentulous patient, one with horizontal centric relation in the apex of the gothic arch; the other in the comfortable position (functional centric, mandible forward). All experiments, it must be realized, are futile until we have the practical response of the patient. We again suggest that two cases be made to convince yourselves that the patient will not accept the dentures which have been registered with the mandible in its most retruded position.

MOVEMENTS OF THE MANDIBLE

Dr. Luce, about forty years ago, said, "The first requisite in the study of jaw movements is to move the jaw; the second, to get a permanent record of the movement."

To better understand the positional relations of the mandible, it is necessary to know something of its movements. The mandible moves in three dimensions and has, therefore, three component movements: (1) the opening and closing movement; (2) the anteroposterior movement, and (3) the lateral movements.

When a restoration is being planned, thought must be given to the type of occlusion necessary or wanted for the particular case. The importance of this consideration must not be overlooked. For cusp tooth occlusion, it is necessary to utilize all three of the component movements of the mandible. The jaw must open for occlusion to function when this type of occlusion is employed. This is classified as three-dimensional occlusion. For cuspless tooth occlusion, it is necessary to utilize only two of the component movements, the anteroposterior and the lateral. No opening movement is necessary for this type of occlusion to function. This is classified as two-dimensional occlusion.

Movement of the mandible associated

with cusp tooth, three-dimensional occlusion is classified as three-dimensional movement. Movement of the mandible associated with cuspless tooth, two-dimensional occlusion is classified as two-dimensional movement, movement in this case being based on the number of component movements involved.

Registration of the movement of the incisor point referred to the occlusal plane in three-dimensional occlusion describes an arcuate (Hall) tracing and is designated as the arcuate movement.

Registration of the movement of the incisor point referred to the occlusal plane in two-dimensional occlusion describes the familiarly known gothic arch tracing and is known as the gothic arch movement.

To differentiate between these two movements and to employ them accordingly makes possible balanced occlusion. Otherwise, attempt to balance occlusion will be but an idle gesture.

The arcuate movement is a vertical, a horizontal backward and sidewise movement.

The gothic arch movement is a horizontal forward and sidewise movement.

The gothic arch movement has forward or protrusive movement in it; whereas the arcuate movement has backward or retrusive movement in it, these movements being, in this respect, diametrically opposite to each other. It is obvious, then, that there is a vast difference between the gothic arch movement of the incisor point and the arcuate movement of the incisor point.

The gothic arch movement is extensive; the arcuate movement is limited so as to appear as a straight line averaging between one thirty-second and one sixteenth inch to either side of the bisection of the anteroposterior registration. *Beyond this range of movement of the mandible, the functional aspect of the occlusion of the teeth ceases; hence, the necessity of recognizing this registration.*

Because of the small range of the arcuate movement, then, it is obvious that check-bites of so small a movement cannot direct adjustment of the customary articulator guides, which require one-quarter of an inch or more for adjustment.

To Rupert E. Hall we are indebted for showing us the light with his interpretation of the arcuate movement. Ironical as it may seem, Dr. Hall has been preaching this theory for many years, but evidently because of its complexity, it never received the attention that it should. Men in our group will testify that when their eyes were opened to the importance of the arcuate movement, it was indeed a revelation, and, to say the least, inspired us to greater study of this subject.

To make a test for the arcuate movement, we again turned to the mouth with natural dentition, selecting a case having well-defined cusp teeth and overbite. Modeling compound was adapted to the labial portion of the upper teeth and gums. A piece of wire forming a loop and eye, carrying a piece of brass tubing to receive a tracing pin, was luted to the compound. Modeling compound was next adapted to the lower teeth in the same manner with a brass plate luted to the compound so that its surface lay parallel to the occlusal plane, serving as a graph plate. None of this in any way interferes with the occlusion or movements of the mandible.

With the tracing pin perpendicular to the occlusal plane and the graph plate parallel to the occlusal plane, lateral movement of the incisor point (mandible) referred to the occlusal plane described a movement substantially at right angles to the median plane within functional range of the occlusion of the teeth. This is the arcuate movement.

The gothic arch movement of the mandible is movement about right and left axes (areas); the arcuate movement of the mandible is movement about a central axis (area).

NEED OF AN ARTICULATOR

To create occlusion in an articulator, it becomes apparent that it will be necessary to have an instrument that can be used both for cuspless tooth occlusion, which is gothic arch two-dimensional occlusion, and for cusp tooth occlusion, arcuate, three-dimensional occlusion.

To emphasize this fact, may I state that nearly every articulator on the market today is two-dimensional, gothic arch in performance; yet men are using them for cusp tooth occlusion, wondering afterwards why grinding was necessary, sometimes to the point that the cusps were nearly all ground off and only inefficient cuspless surfaces remained. To emphasize the truth of this statement, it is suggested that models of one's own mouth be made and mounted on any popular adjustable articulator. When the articulator is moved in its prescribed adjusted movements, it will be noted that these movements do not simulate movements of the jaw in normal excursion executing the movements of the mandible as in mastication.

Study of this subject has convinced us that the best to be expected from any articulator would be to meet the following requirements:

1. To be able to utilize both the arcuate and gothic arch registrations so that either cusp teeth or cuspless teeth can be made to function properly in the mouth.

2. To be so constructed that moving parts can be made stationary and so be able to function only as a plain line instrument. Check-bites taken of positional relations of the mandible could then be recorded in their individual static positions.

3. To be so constructed that any movement of the articulator would be average mandibular movements consistent with the accepted findings of various investigators.

CONCLUSION

1. The apex or the gothic arch is developed with the mandible in its most retruded position. Since the muscles are under strain when the mandible is held in retrusion, the apex of the gothic arch could not be the true centric position of the mandible. Centric relation of the mandible is not a strained relation.

2. In order to balance occlusion in an articulator, it is necessary that the articulator reproduce movement of the incisor point that harmonizes with the form of teeth (occlusion) that we employ.

3. Lateral movement of the incisor point associated with cuspless tooth occlusion is gothic arch in character.

4. Lateral movement of the incisor point associated with cusp tooth occlusion is arcuate in character.

5. Lateral movement of the incisor point associated with cuspless tooth occlusion embodies two only of the component movements of the mandible; namely, the protrusive and the lateral.

6. Lateral movement of the incisor point associated with cusp tooth occlusion embodies all three component movements of the mandible; namely, the protrusive, the lateral and the opening.

In presenting our efforts, we wish only to promote the truth. We solicit your honest opinion and criticism, constructive or otherwise. No one individual or group of individuals can be right 100 per cent.

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PSYCHOLOGY AND CHILDREN'S DENTAL PRACTICE

By Frank F. Lamons, D.D.S., Atlanta, Ga.

PSYCHOLOGY is defined as the science of the mind; the systematic knowledge and investigation of the genesis, powers and functions of the mind. Psychology is essentially a study of man's thoughts, feelings and motives, and the impulses which lead to certain actions or non-actions. In the practice of dentistry for children, it simply means getting along with the child and having the greatest success with the least effort. It means getting the fullest cooperation from the child while performing the necessary dental operations. It means success in dentistry for children.

In all branches of the healing art, some phase of psychology is employed in dealing with the individual patient. The profession as a whole uses this great science in everyday practice because we are dealing with the thoughts, feelings and motives of our patients. In working with children, the thoughts and feelings of the patient must receive more than the usual consideration. Children do not reason: they have not reached the age of logical thinking; and they take nothing for granted, but measure our actions by some previous experience, an experience limited to a very small world. They are, however, very susceptible to suggestion. It is because of this that we as dentists are often able to successfully perform painful operations with a minimum of effort, that we are able to render service in the restoration of the health of the mouth for even the very small child.

This power of suggestion is not a "hypnotic" influence which the dentist may have over the child. It is the conscious (or perhaps unconscious) effort on the part of the operator to apply some of the principles of psychology in his practice. It may be done through direct suggestion to the child by the dentist, or by indirect suggestion through the use of familiar objects and surroundings, such as a doll house dental cabinet and toys in the office. It may be done by a competent office nurse or assistant, or it may be more successfully accomplished through suggestion to the parents.

The dentist who successfully manages children probably does so, in the majority of cases, through the habit of following a few simple rules rather than the conscious application of the principles of child psychology. I would not suggest that he study psychology and become thoroughly familiar with it after the academic fashion. I would suggest that he study his own attitudes, feelings and actions toward the child, as well as the child's toward him. A study of the surroundings may prove helpful, and a study of the parents and home life will, in many cases, be of great assistance.

In a full consideration of psychology and children's dental practice, three people are involved: (1) the dentist; (2), the child, and (3) the parent or parents.

THE DENTIST

I have named the dentist first because he is the first who must make the neces-

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sary adjustment. He must be in a frame of mind to welcome the child to his office and to the benefits of the service that he has to render. To reach this mental attitude, it may be necessary for the dentist to revolutionize his ideas of the importance of dentistry for children. He may have to reeducate himself in the most modern methods of dental service and prevention, or he may have to adopt a policy of reeducating the public as to the importance of the deciduous teeth rather than the policy of "leave them alone, they will soon be lost anyway." Unless the dentist has the attitude of service to the child and welcomes the opportunity of rendering this service, he misses the first principle of psychology in children's dental practice, and is doomed to failure in his attempts to work for the child.

With the welcoming attitude in his mind and heart, the dentist will do well to analyze another phase of the psychology of child management; namely, his technic in handling the child, which includes his approach, his conversation and the tone of his voice. Even his appearance and personal mannerisms should be studied.

In a recent book, "Big Problems on Little Shoulders," by Carl and Mildred Renz, the introduction begins:

> What is on your child's mind? No parent can answer this question until he discards the grown-up glasses a muddled maturity has set upon his nose and looks out upon the world through the clear, unguarded eyes of childhood. What he sees when he is able to look through a child's eyes may loom astonishingly large or dwindle to surprisingly small proportions in the frame of youthful perspective.

It makes a great deal of difference whether we look at the child's dental problems from the child's standpoint or assume that he has the knowledge of dentistry that the average adult has and approach him in the same manner in which we approach adult patients. At the same time, we can underestimate the mental development of the child and treat him as a baby, using baby talk, expressions and methods that might be used in handling a baby. This would insult the average 6-year-old and would lead to disgust on his part and failure on our part. We should look on the child as of limited experience, but not necessarily of too limited intelligence. His experiences have played a vital part in his education up to the present moment. He is now about to have a new experience and one that he may be looking forward to with some degree of anticipation and pleasure or with mortal fear. His attitude will depend on just what previous experience he is comparing the unexpected experience with, and our success will depend on the control of his mind through the power of suggestion, and our ability to lead his thoughts along pleasant lines.

One of the first things that we must do is to put the child at ease in our presence. The perfect host is often the person who can put his guest at ease and make him feel perfectly at home in his presence and in his home. We are the host and our child patients are the guests in our office. The simplest method of putting our guest at ease is to engage him in conversation. A few simple questions about things in the world in which he lives are often sufficient to start him talking. He is interested in his playmates, his new pet or toy, his school and teacher or the trip he is soon to take to the beach or to his grandmother's. If we can find his world, whatever it is, and look through his glasses, we are on the road to establishing in his mind a confidence in us that will mean success. As soon as possible, we can lead the discussion to his teeth. I have found the following a good leading question: "Well, John, have you been having some trouble with your teeth, or did you come to keep from having some trouble sometime when you want to play or take a trip?" This usually brings up the trouble and starts the conversation off

along dental lines, which is our opportunity to tell the story of dental health, and through the power of suggestion make the patient realize the importance of his teeth, instilling in him an eager desire to have his mouth put in a healthy condition. We are on the verge of winning a new friend and making a life-long patient and booster.

It is often difficult to get a child to talk. He must first make his personal appraisal of us and decide whether we are to be trusted or to be feared. It is never wise to force conversation or to attempt to rush the child into talking. Neither is it wise to attempt to rush the child into opening his mouth for us to make an examination. Particularly is this true on the first visit. If we appear in a hurry, we may create the impression in the mind of the child that we are trying to take advantage of him, and this breeds a spirit of distrust that it is hard to overcome. Analyze this statement from your own point of view: Would you feel quite as safe about an operation if you felt the surgeon was trying to rush you into it? Would you purchase something in a store if you felt the clerk was trying to rush you into buying it? You would feel as if something were wrong and would revolt against such tactics. The same is true with the child when we are in too much of a hurry. The old adage "Make haste slowly" applies aptly here.

We must not be afraid to answer questions for the child, but should welcome them and make an honest effort to answer them in an intelligent manner so that the child will understand. Sometimes, questions may come too rapidly, but we can counteract this by making our answers a little more detailed, and, through our answers, turn the questions of the child to useful ones about teeth. Mothers will often scold and say, "Don't ask so many questions, you worry the doctor." We should encourage questions. A child who is asking questions is an interested child, and an interested child has confidence in us, or soon will have if we do not try to suppress him.

If the child refuses to talk, our conversation should be directed to the parent, and, by simple language which the child can understand, we can lead the mind of the child along until we have, through the psychology of suggestion, won over an otherwise difficult child. The one great difficulty here is that the mother may become the center of attraction: she will lead the conversation and dominate the thought; and this should never be the case. It is the child we are endeavoring to serve, and the child should be the center of attraction. The parents should not be allowed to answer questions that you should expect the patient to answer. In this situation, a well-trained nurse will be of great assistance. She can tactfully tell the parent before entering the operating room to answer only the questions that are directed to her, and to let the child do most of the talking.

I consider the ability to reach the mental level of the child and to carry on a purposeful conversation, in language that he will understand, of paramount importance in the psychology of child management. The dentist can certainly train himself along this line. Let us test ourselves with the children of our friends or our own child; or visit an orphanage and see how long we can talk to a five-year-old child without having to play ball with him. We may find it a help to read several books written for children. This will be an excellent means of relaxation and will take our minds away from scientific language and give us the language of the child. It will do more: it will enable us to more logically follow the thoughts, feelings and motives of the mind of the child patient. It will suggest clues that we may use in leading the thoughts of the child through the power of suggestion. We should not expect when presenting the story of oral health to talk to an eight-year-old child as we would to a learned engineer. The reading of books and stories

written for children will enable us to weave a story of good teeth around something the child is familiar with and make it more effective.

It will afford an approach to the child that begets confidence and trust. The child has found an intelligent person that he can talk to. The most experienced operator cannot perform the simplest operation so successfully if he does not enjoy at least some measure of trust on the part of his patient, whether child or adult. The more trust the child places in us, the more cooperation he will give, and, in turn, the more successful will be our work. This will be true from the standpoint not only of quality but also of quantity.

Along with the psychology of the dentist should be mentioned the physical equipment of the dental office and the part it may play in psychology and children's practice. The equipment need not be different, yet children like things which are made especially for them. The dentist will find a special operating room with juvenile equipment a distinct advantage. The young patients will enjoy it and the dentist will find his own attitude different when working in this room. He will also find it a psychologic factor in his influence on the parents, as well as in the community. It sets him forth as one especially equipped to work for children, and makes his services for them seem more important to the parents. If the special operating room is not practical, the addition of suitable toys and other familiar objects will make the child feel more at home. One corner of the reception room should be fixed up with a small table, small chairs and suitable pictures on the walls. There should also be suitable books and magazines and perhaps a puzzle game or two to amuse the young patients. An aquarium or a canary may be helpful in amusing children and may be in either the operating room or the reception room. The children's room of any department store will offer many suggestions for making our offices attractive to children.

THE CHILD

The psychology of the individual child is perhaps more interesting than that of the dentist or the parent. It is the one most written about in discussing this subject, and probably the most difficult to present in a helpful manner. Each child is an individual and must be considered as such. He may fit into the group pattern, but, in the final analysis, his individuality and our ability to cope with it will determine our success. It is neither feasible nor advisable to attempt a discussion of the individual child, but a discussion of certain groups may be found helpful in dealing with the individual.

I have found that certain groups or types of children come to the office and each requires a different treatment. Not all children can be easily placed in a group, but the outstanding typal characters can, and group study helps in managing them.

The first group is the fear group: the child is frightened or figuratively "scared to death." This child will not raise a scene, but will cling closely to the mother and depend on her as a shield from the dentist. Such children are frightened because of the harrowing tales that they have heard about the dentist from their elders or their playmates. They have heard at the dinner table from their mother about how Dr. Doe nearly killed her today while filling her tooth. The child does not discount the statement as an adult would and these stories may be magnified to such a degree that the child suffers on even thinking of the dentist. Children will not realize that their mother enjoys a bit of exaggeration because it makes her feel brave to think that she has endured such a terrible ordeal.

The dental profession seems to be noted for its pain-inflicting powers. Adults make capital jokes of it. The press makes a joke of it, and rarely does a layman address a

dental group but that he begins his remarks, "I have suffered at the hands of your profession and now it is my turn to inflict a little pain on you." Then he tells of some experience which was such a harrowing ordeal that he has barely lived through it, and how he is out to get revenge. Children hear these stories and accept them as truths; consequently, we have the child who is in reality afraid of the dentist. We should educate parents to help overcome this by telling their children the nice things they may know about us and not the unpleasant things.

The "fear" children must not be rushed. We must talk in low, modulated tones, using language that they can understand, and reassure them, smile at them and encourage them to talk to us. If they will not, then we should talk slowly to the mother so that the child can understand what we are talking about. It may take a little time, but when we have won this child over, we have a good patient. Let us be careful on the first visit to explain each step of our procedure, and gradually we can overcome fear and build up trust and confidence. Persuasion and reassurance help us here, never force.

The second group is the high-strung, nervous type, the extremely temperamental and hysterical child. This child is more difficult to handle. We usually find that one or both parents are of the same temperament; often divorced, or should be. The presence of the mother in the operating room with this child is not desirable. We can accomplish more alone, and should insist on being alone. This patient usually cries and makes a scene. We should not attempt too much conversation nor wait too long before starting to work. Of course, we should do nothing to hurt the child, but we must do something. The longer we wait, the more hysterical the child becomes and the bigger problem we have in winning him over. We should work calmly, slowly and carefully and not become excited. Children are quick to sense any excitement in the dentist, especially if he raises his voice, frowns or appears nervous. The child may even, on the second or third appointment, have the same emotional upset, but calmness on our part, with something accomplished each visit and the help of the parents between visits, will gradually reassure him. Between appointments, the parent should not refer to visits to the office except in the most pleasant terms, and, above all, should not sympathize with the child or take the child's part. We should talk privately to the mother and tell her just what to say to the child, which should always be something to build us up in the child's mind. Later, we may find that we can employ a little sympathy to a great advantage because the child is accustomed to it and expects it, and it gives him the feeling of a closer relationship to the dentist and sends him away in a better frame of mind. He is more likely to come back on the next visit a happier patient, ready to cooperate.

The place of the mother of this child is in the reception room; for then we have only one hysterical person to deal with instead of two.

The third group is the shy and bashful type. These children are not afraid and we can usually go to work. They will not talk and will not look at the dentist while he is talking. Unless we go slowly at first, these patients may, on the second or third appointment, change to the fear group and become difficult to handle. We never know just where we stand with these children until we have become well enough acquainted with them that they respond to our questions and feel at ease in our presence. The psychologist might class these children as introverts. To the dentist, they are good patients, but it requires careful handling to keep them that way. We should not take too much for granted when working for the children of this group. We should not impose on them, just because they are good at the start, and thus they will remain coopera-

tive. We should watch for signs of fear and guard against it carefully. The presence of the mother when the dentist is working for these children may be advantageous. We should, however, be careful about directing too much conversation to her and neglecting the things the child may be interested in.

The fourth group is the incorrigible type. This may be the bully on the playground, or the "smart aleck." Usually it is the spoiled child who always has his way at home and intends to have it in our office. When he says "No" at home, he means "No" and he usually gets his way. He often has bad dietary habits and poor mouth hygiene habits. As a rule, considerable work is necessary because he has been able to put off this visit to the dentist.

Forceful dealing with this type is often necessary. They must understand that we are "the boss" in our office, that they have some dental work which must be done, and because we have been selected to do it, we are going to do it. We should never lose our temper, but, with a smile, let them know that we mean business. It is with this type that the use of the towel over the mouth is sometimes necessary. We may tell the child that we are doing it to keep him from disturbing the other people in the building. When he complains of smothering, we may tell him with a smile that we will be glad to stop holding him as soon as he is ready to let us work. When he finds that we are in earnest, that we cannot be "bluffed," and that we are not angry but are ready to help him, we can go to work, and usually with a patient who is ready to cooperate. Pleasant explanations of procedure and what we are trying to accomplish will make him interested, and so he becomes obedient.

I am fully aware of the objections raised by many of the profession as to this method of handling this particular type of child, but I have found nothing so effective, nor anything that saves so much time, and I have yet to find the child who was subjected to this method and afterwards resented the treatment It is always wise to tell the parents just what we are going to do and get their consent. They will then have no occasion to resent this practice and the dentist will make lasting friends of both parent and child. Of course, the place of the mother is in the reception room, always.

Other types should be mentioned, such as the precocious and the mentally retarded types. Both are rare and do not present problems of unusual importance. Both are very distinctive and can generally be handled without difficulty. The precocious child may become hysterical if too little time is given him for adjustment, because he is usually highstrung, but he responds to reasoning and is cooperative. With the mentally retarded child, we must work much more slowly and move very deliberately.

There is still another group which rarely comes to the office but for which we should be constantly on the watch. This is the sick child. I do not mean to refer to those who may have some acute dental condition, but children who are sick generally. It is wise to have a clinical thermometer at hand, and when suspicious, take the child's temperature. If found to have a degree or more of fever, he should be sent to his physician. Such a child becomes tired very easily. He may be developing some acute infectious disease, and on subsequent visits will be a difficult patient because of this experience.

THE PARENT

The third group to be considered is the parent or parents. They want their children to have the best, and to have advantages which they did not have when they were children. They have been educated by the radio, the Parent-Teacher Association, the public health authorities, the newspaper column and the baby books. In fact, they have garnered much

information about the teeth of children, but after all it is general information they have, and not the specific information about their own child's mouth which they should have.

They do not always know that the deciduous molars must serve until the child is 11 or 12 years of age; nor do they realize that the first permanent molar is a permanent tooth and must last the rest of the child's life. They cannot see the tiny pits and fissures in these first permanent molars, unless we point them out. They cannot see the reason for filling these pits and fissure defects when there is no decay, unless we explain the preventive value of such an operation.

The psychology of the parents in children's dental practice is a reeducation in the particular dentistry their own child needs, illustrated by specific instances. On the first visit, a thorough examination should be made, the mouth charted and the treatment outlined. Then the parent or parents should be given an adequate explanation of the child's needs along with our plan of treatment, and be told the approximate cost. Such explanations will tend to convince them of the importance of our work and the importance of the service we are to render *their* child. They will appreciate our efforts more and realize that dentistry for children really is a health service.

I give parents three reasons for filling deciduous teeth and for taking care of the mouth generally: The first is to maintain the proper function of these teeth. If teeth are important, they should be maintained at their greatest efficiency because of the function they are called on to perform. Any valid reason which can be applied to the importance of filling the permanent teeth, putting in bridges or even making artificial dentures to afford function can be used as an argument for filling deciduous teeth.

The second reason is to prevent abscess formation with the resulting sequelae of systemic infection. An abscessed deciduous tooth is just as much a menace to general health as an abscessed permanent tooth.

The third reason is to prevent pain. Some of the greatest philanthropies of the world today are organized to prevent pain, both physical and mental, in children. The filling of deciduous teeth will prevent many a toothache and becomes a real service from this standpoint alone.

The reeducation of the parent may also be needed in the matter of the fee charged. We have become so accustomed to children paying half price that many parents expect them to occupy the dental chair for half price. The child does not stay in the best rooms in our hospitals for half price. Surgeons do not operate on a child for half price, nor does the oculist examine his eyes for half price; but unless we reeducate parents as to the effort expended and the time involved, as well as the value of our services, they may expect us to work for half price just because we are working for children.

The most cooperative parents are those who know the value of the service they are getting and how much they are paying for it. The best time to tell them this is before any work is begun.

CONCLUSIONS

Psychology is important in children's dental practice and has many practical applications. The dentist who would be successful in the practice of dentistry for children must first look to his own attitude, his shortcomings with children and the psychology of his own appeal to them. He can improve his technic and his ability to work for children by the study of a few of the simpler psychologic factors involved.

Children must be studied as individuals. The study of psychologic types and groups is of value and aids us in understanding the individual, but they cannot be put into a group pattern and then be managed according to a given formula. Common sense is always valuable.

Parents must be reeducated as to the needs of their own child in order to secure their best cooperation.

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Doctors' Building.

DISCUSSION

E. C. Geiger, Jacksonville, Fla.:

"Psychology, in the practice of dentistry for children, simply means getting along with the child and having the greatest success with the least effort." Psychology will barely suffice to enable us to enjoy pleasant dental contacts with the greatest success with the least effort, unless we are sufficiently equipped to render dental service for children in a smooth efficient manner. The one is so dependent on the other that, through my limited experience with children, I would suggest the following term and definition: The term "psychodontia" to replace the term pedodontia, if I may be allowed to coin a descriptive name for children's dentistry. Fifty per cent of successful and practical pedodontia is psychology, and the remaining 50 per cent includes certain definite principles and clever technic in handling decidous teeth, which may often vary from the usual technical procedure in adults. Psychodontia is necessarily an integral part of successful general practice; but without it, there would be no practical pedodontia. It includes also the use of visual education, and other modes and methods of interesting children in personal dental health.

In other words, an operator may be rough and ready with many adults and "get away with it," but never with children.

Pleasant surroundings, as Dr. Lamons pointed out, are important. A small office radio is entertaining to children and creates a homelike atmosphere. It may be wise to remove spectacles and white operating coat prior to introduction to a new child patient. A few minutes spent at this time talking or looking through a magazine is valuable. Remember the child's first name always. The child soon comes to think of the dentist as a human being, not greatly unlike the child's father. A child's mental picture of the dentist is so often horrible because he has been threatened with, "I'll take you to the dentist if you aren't good, and he'll pull your teeth." Children overhear conversations at home relative to dental subjects which produce apprehension and foreboding. They often become acquainted with the words "needle" and "drill" in an unpleasant way at home, and are on the defensive psychologically. The assistant and operator should talk of interesting subjects, but never indulge in "baby talk," never appear to be in a hurry and always talk quietly. The arm rest may be removed to permit the operator to partially sit in the chair facing the child, and to ask questions about dolls, dogs, the baseball team, etc., with eyes on the same level as those of the patient. Well-selected flattery always helps, such as expressions of admiration for a pretty dress or an aviator's helmet, or such remarks as "Isn't your daddy a big strong fellow?"

Sympathetic parents and relatives should never be allowed to accompany the child into the operating room after the first visit, especially at the time of an extraction. This operation appears gory to the lay person, and the dentist is considered heartless to treat the child in such a manner. The facial expression of a grandmother will frighten the operator even if it does not the child.

Do not allow the patient to see a hypodermic syringe, forceps or instruments, if possible, but never make an obvious movement to hide one. Cleverness in manipulation of instruments, coupled with a

positive psychology, will do much to allay the age-old fear and apprehension of dental treatment, and shares an important place with diet as step No. 1 in preventive dentistry.

If a child shows curiosity regarding an instrument, show it to him. A facial appearance of pleasantness and unconcern is necessary. A smile is a most valuable asset, because the patient determines the seriousness of the situation by our facial expression. Our face is about all the child can see, and a sad, stolid, funereal-like countenance is not conducive to unconcern, relaxation and confidence on the part of the patient. This might be summed up as pleasant sincerity by the operator, and is induced only by love for children and a knowledge of children's dentistry and psychology. It is a prerequisite that the operator feel well. Regular rest, diet and recreation will induce good humor, patience and tolerance.

The power of suggestion, as Dr. Lamons points out, is one of our most effective weapons. It is necessary to use positive psychology or pleasant association of thought at all times. During an injection, we may suggest, "open wide like an alligator," and, "this *will* feel like a little mosquito bite." The cracking sound of the alveolar process and peridental fibers in extractions will frighten many children even though pain is absent, and a commonplace illustration of association of thought may be "This *will* sound like eating cornflakes or biting toast for breakfast." The hum and vibration of the engine and bur may be likened to a "motor boat," etc.

Any paper or discussion on children's dentistry would be incomplete without mention of sharp hand instruments, new burs, good stones and a true running handpiece. It has been my observation that children will tolerate a steady jet of compressed air during the use of burs rather than water. A miniature handpiece and burs are most valuable.

A doubled cotton roll placed over the socket immediately after removal of a tooth, and on which the child is instructed to bite, will absorb the excess blood and never be seen by the patient if dextrously removed. A mouthwash colored red is good for a similar purpose, especially if the child threatens to cry. However, it must be remembered that saliva should not be allowed to enter an open socket, and a quick insertion of an ointment of ethyl aminobenzoate into the wound is good practice in many instances.

We must employ pleasant association of thought through the power of suggestion, and never use negative psychology as illustrated by such statements as "this will not hurt a bit." A statement of this kind infers that the operator is capable of causing pain and the patient is entirely at his mercy.

The length of time for each appointment is important, in view of the fact that the psychologic span of attention time for a child is twenty minutes. The forenoon is generally accepted as the best time of the day for child appointments. A tired, nervous, apprehensive young patient who comes in for treatment at 4 o'clock in the afternoon is not a very fertile field for psychologic efforts at persuasion.

The study and practical use of psychology or "psychodontia" in children's dental practice will do much to disprove the philosophy of Francis Bacon, who said "The remedy is worse than the disease." We may then have a greater following of child patients, who will refer to us as "my dentist." There is nothing more possessive than a child in a case of this kind, and we most assuredly like it.

PARTIAL DENTURES THAT FUNCTION—PARTIAL DENTURES THAT FAIL

By Irving R. Hardy, D.M.D., New York City

A PARTIAL denture which entirely meets the requirements of functional occlusion or is otherwise ideal in every respect is, to my knowledge, seldom or never seen. On the other hand, there are so many failures in partial prosthesis that could have been avoided by the application of a few simple principles of design that I shall resort to comparison to emphasize these points.

Dentures that fail may fail in varying degrees. Many partial dentures are not even worn by the patient and hence may be called utter failures. Others are tolerated by the wearer, but do so much damage to remaining teeth and oral tissues that they must also be termed failures. These appliances that fall in the failure class may be generally indicted on the following counts: 1. They lack adequate occlusal supports. 2. Their saddle areas are almost invariably too small.

Figure 1, left, represents a cross-section of a lower bicuspid tooth which has been improperly prepared to take an occlusal rest. An occlusal lug placed on a tooth so prepared will, of course, when pressure is applied to the denture, tend to slide off the inclined plane on which it is placed. When such a movement occurs, the saddle portion of the appliance is thrown out of position on the underlying tissue and the whole mechanism is put in maladjustment.

Figure 1, right, shows what I believe to be a correctly ground lug rest. The lug which is placed in this declivity will, when pressure is applied, seat itself firmly and remain where its designer intended that it should.

With the occlusal plane as a horizontal base line, the floor of any occlusal lug rest should be inclined, its deepest point being toward the long axis of the tooth.

I am not of a mind with men who hold that a rest should never be made except in a metallic filling. I do, however, believe that a shallow lug rest demands a different clasp treatment than that employed where a deep rest is used in a metallic filling. In the Gillett type of clasp and rest, with which all are familiar, wire clasps engage the tooth on both the buccal and the lingual aspect and a lug fits accurately into a deep socket in a gold inlay. This type of retainer works well. Where a shallow rest is employed, one clasp arm had best be of rigid construction and the opposing arm of round

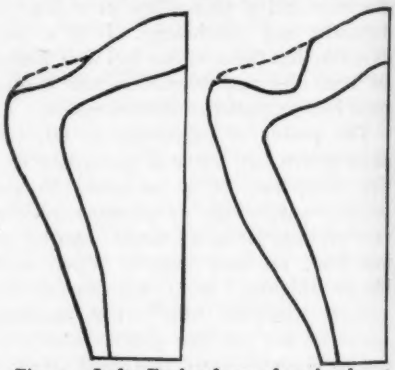

Fig. 1.—Left: Faulty form of occlusal rest. Right: Proper form of lug rest.

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wire. This design prevents the appliance from exerting orthodontic pressure on the clasped tooth. All clasp adjustments are made by manipulating the wire arm, and even if too great pressure is exerted by the flexible arm, the abutment tooth, because it is definitely cradled by a rigid clasp opposing the wire arm, will not readily be pushed out of position. If wire clasps are used both buccally and lingually in connection with a shallow lug rest, one of these flexible arms will nearly always be adjusted to exert more force than the other, with a resulting orthodontic influence on the tooth involved.

The cuspid is a difficult tooth on which to obtain proper resting surface for a supporting lug for a denture. Figure 2

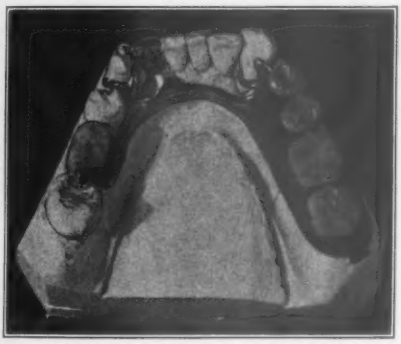

Fig. 2.—Type of lug rest often employed with little value as a supporting structure.

shows a type, often employed, which has a negligible value as a supporting structure. Whether it was this rest that drove the lower cuspid forward by its pressure on the inclined plane formed by the lingual surface of the tooth, I do not know. I do know that as support for a partial denture at this point, it was inadequate and did not serve the purpose its designer intended.

Figure 3 shows a model of a type of rest that offers definite support, a lug rest made in a metallic filling. It conforms to the definition given for a proper rest in that its floor is slightly inclined, its deepest point being toward the long axis of the tooth. The more firmly pressure is applied to the appliance, the more firmly will the lug that occupies this rest seat itself.

There is another type of support which may often be used in the mandibular cuspid and which will function as definite support for a denture. (Fig. 4.) It is prepared for by creating a definite notch in the cutting edge of the tooth. The cut is started with a knife-edged stone at a point about one-third the distance from the mesio-incisal angle to the crest of the cusp. The notch is carried well over on the labial side and into the

Fig. 3.—Type of rest that affords definite support.

lingual enamel plate as well. After the cutting with the stone is finished, the prepared area is smoothed with sandpaper disks and all the grinding is done in such a way as to leave a very definite notched seat to receive a finger which will occupy it. This finger is cast *en bloc* with the lingual arm of the clasp and is of rigid construction, as is also the clasp arm of which it is really an integral part. In the mouth of the patient, such a supporting finger is not unduly conspicuous. If the preparation for the finger is made as described, the upper border of the

finger forms an almost continuous plane with the anterior slope of the cusp, and is therefore not especially noticeable. If, for any reason, even this small display of gold is objectionable, the rest can be placed in a properly prepared notch in the distal slope of the tooth, where it will be even less in evidence. (Fig. 5.) This type of rest I have used for about four years, with what I believe to be satisfactory results.

Some points of caution in its use might be made: It must be kept free of the bite so that it will not be subjected to undue wear and so weakened and its usefulness destroyed. I use this type of rest with best success in those cases wherein a lingual bar lower case is constructed against a full upper denture and the bite can be opened to allow ample room for proper clearance.

Fig. 4.—Another type of lug rest that affords definite support.

In discussing the second factor in partial denture failure, insufficient saddle area coverage, I submit an illustration (Fig. 6) of a lower lingual bar denture which was not used because it was uncomfortable. It is faulty in lug construction, as can be seen, but it is also sadly lacking in saddle area. The denture made to replace this one (Fig. 7) covered a much greater tissue area, and as the ridge was well shaped to take the pressure, there seemed no need to diminish that pressure by using smaller teeth on the replacement bridge than were used on the one that failed. I mention this to emphasize the fact that the occlusal load is therefore approximately the same for both dentures.

Comparison of the dentures, viewed from the tissue side, is even more striking than in the occlusal view. There is at least one-third more saddle coverage on the replacement denture and the borders are rounded and polished so that they can be carried to the limits of tolerance. The posterior border is carried well over the tissue pad in the retromolar area instead of terminating farther forward, where the border might cut into the underlying tissue. This denture functions against the natural maxillary teeth.

Fig. 5.—Modification of type of rest shown in Figure 4, but showing less metal.

I have in mind another type of mouth for which an original denture as constructed was a failure. I never saw the failure, but I am sure that the major reasons for it were as usual: inadequate occlusal support and inadequate saddle coverage.

In this mouth, all the mandibular teeth posterior to the first bicuspids are missing, and a cross-section of the ridge in the second bicuspid region shows a sharp knifelike area, not at all suited to a heavy

occlusal load. Proper occlusal support from the remaining natural teeth can, however, be made to take the most severe biting pressure off the ridge at this point. The ridge in the area normally occupied by the distal portion of the first molar and the second molar is of an entirely different character. Here, it presents a fairly broad, almost horizontal plateau, well capable of taking the load of the denture base. The denture built for this mouth and now worn provided adequate occlusal support with proper lugs and full coverage of all available saddle areas. The occlusal stress was somewhat minimized by using bicuspid teeth only as supplies and utilizing only the lingual cusps, the buccal cusps being ground out of occlusion. This denture functions against a full maxillary denture.

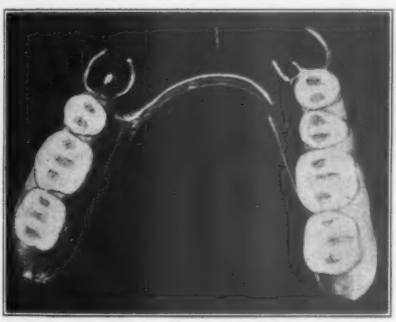

Fig. 6.—Type of partial denture with insufficient saddle area coverage.

Fig. 7.—Proper saddle area coverage.

Operators who feel that by cutting down the size of the saddles, and thus decreasing the bulk of the dentures, they are making them easier to wear are nearly always making trouble for themselves and their patients. Full denture prosthetists are fully extending their bases and getting better results than they have ever attained, and men who construct partial dentures can well follow their example.

In making large partial upper dentures, such as are necessary to supply all teeth posterior to the cuspids or first bicuspids, I have of late kept away from the open palate type of construction. I have in mind such a case in which first bicuspids were to serve as anchorage and were extremely divergent in their long axes. Wide divergence of abutments necessitates the use of a mesiodistal clasp on one side, while the opposite side is grasped by a buccolingual type of retainer. By using a denture covering nearly the entire vault, extending back to an area which can be well postdammed, and a considerable adhesion of the denture to the tissue be so obtained, the strain on the abutment teeth will be considerably lessened. A skeletal type of appliance would exhibit no such adhesion and would tend to sag at the posterior border and put a heavy strain on the abutments, especially on the tooth which is clasped mesiodistally. The larger saddle area coverage also helps prevent rapid settling and the appliance is less of a food collector than is a skeleton type. The covering of a larger palatal area may seem to some a step backward from an open palate design, but I believe that it is a sounder mechanical principle and will produce a denture which will give a considerably longer period of service.

To those of you who are familiar with the work of Bonwill, Kennedy, Cummer and Doxtater, and of other authors who have treated the partial denture problem exhaustively, I apologize for the ele-

mentary character of my presentation. I realize that in concentrating comment on occlusal support and on saddle area coverage, I have left untouched many important phases of partial denture construction. I do not ignore these other factors, but I believe that the two points I have sought to bring out are of paramount importance. Having seen so many cases in which they were ignored, with the subsequent disastrous failures, I believe they must be stressed even at the risk of seeming repetitious.

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DANGERS IN DENTAL RECONSTRUCTION INVOLVING INCREASE OF THE VERTICAL DIMENSION OF THE LOWER THIRD OF THE HUMAN FACE

By Russell Wilford Tench, D.D.S., New York City

SINCE the enthusiastic advocates of dental reconstruction for the purpose of "restoring" the loss of vertical dimension of the lower third of the human face have aroused so much interest in their presentations, it would seem the proper time to warn those who may be inclined to enter this field without adequate preparation that such procedures are quite often doomed to failure. The biologic balance of the body is predetermined in a delicate way for each individual. When this balance is upset, the mouth displays visible evidence of the dysfunction, for often caries develops and teeth are lost; or dysfunctional wear or erosion may be observed. If the lost teeth are not replaced, the remaining teeth may wear down and tip, and so the bite becomes closed, with a resultant shortening of the lower third of the face. The shortening of this dimension affects the appearance, giving the effect of age prematurely. The dentist who does not consider biologic aspects involved, but who knows human nature and possesses the instinct of the cosmetician, like his near kin, the face-lifting plastic surgeon, finds little difficulty in inducing women so afflicted to undergo the prolonged and expensive treatment necessary to restore, temporarily, the shortened dimension. He can also threaten the prospective patient with possible impaired hearing, for dental literature bears plentiful reference to the supposed adverse influence of loss of vertical dimension on hearing, although no one has taken the trouble to present scientific evidence that hearing can be impaired by a closed bite, nor is there conclusive proof that impaired hearing has ever been even partly restored to normal by opening the bite. Pseudo-proof has been advanced, but the technic and technicians involved have not been faultless. These bite openers and occlusion advancers are gifted with a peculiar form of reasoning. They, on the one hand, condemn Nature for being too inefficient to effect adjustments of function that they assert may be disturbed by a closed bite, but they forget that when the bite is opened, even by a super-dentist thoroughly grounded and trained in the pro-

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cedures necessary, Nature is called on to abruptly make several adjustments without which their efforts are doomed to failure. And their efforts do result in failure in far too many instances; for Nature does make adjustments to secure biologic balance, and often shortens the face to the original short dimension. When the loss of teeth or abrasion causes a shortening of the vertical dimension of the lower third of the face, the effect is one of adjustment to meet changed conditions.

I believe that the force of mastication under usual conditions is uniform so long as the masticating action is ordinary and automatic, and not consciously directed. Obviously, ordinary mastication is not consciously directed, but automatic in respect to the coordination and pull of the muscles involved. This muscle action creates force, and this force is always the same for a given individual as long as it is automatic. Hence, the force, being constant, causes us to sense that this food is soft and easily chewed because the normal automatic force applied to the food is more than enough to crush the food; or it causes us to sense that food is hard or tough because the constant muscle force is not enough to chew it quite easily.

If the muscle force was automatically increased as it met resistance, would we know that food was soft or hard? Quite obviously if the muscle force were automatically variable to suit the conditions, we would *not* sense that food was hard or soft.

This constancy of the masticatory force is the very cause of closing of the bite. With the loss of teeth, the bony areas of the jaws resisting the constant muscle force are decreased. When the individual index of bone resistance is less than enough to maintain tooth position against the opposing constant muscle force at a previous bite opening, teeth tip or wear, or are depressed to the point where the muscle pressure is decreased enough to balance the bone resistance under the changed condition. The bone allows the teeth to shift just enough to restore the balance between the stress of musculature and the ability of the tooth investing bone to resist the force and maintain the status quo.

If there are sent out from the brain nerve impulses, due either to emotional or to other abnormal excitation, which cause the teeth to be under muscle stress more or less constantly between meals, we may expect those circumstances, under certain conditions of bone resistance, to result in shortening of the lower third of the face. If the bone resistance of the alveolar process is so great that the application of muscle force cannot cause a change in the position of the teeth in the alveoli, there cannot be any shortening of the lower third of the face except through the wear caused by chewing of abrasive foods. Patients presenting this condition might be good subjects for moderate degrees of bite opening. The same might be said of patients whose teeth do not tip or shorten when adjacent teeth are removed from the arch. Of course, these patients do not need bite opening for cosmetic reasons, and hence our most favorable subjects cannot be used for this type of treatment.

Let me cite several instances in which dental reconstruction applied to more or less complete dentitions failed.

1. A woman dentist in her late thirties with hearing impaired was advised by the late George Monson, who started this fad, to have gold splints applied to the occlusal aspect of the lower molars and bicuspids, to open the bite and advance the condyle, the object being to reduce pressure on the tympanic plate, relieve congestion and improve the hearing. This patient's dentition was exceptionally fine. The result of the treatment was no improvement in her hearing at the end of a year, but the incisors which had been separated by the splint were then in contact. Removal of the splints disclosed that the posterior teeth were separated

from their antagonists by the thickness of the splint. Why? Because Nature's balance had been upset by the splints. Muscles do not increase in length to accommodate dentists. The posterior teeth were driven into infraclusion by Nature's attempt to relieve muscle strain. There was a contest between the endurance of the muscles of mastication and the resistance of the alveolar bone, and the muscles won.

2. A woman in her late forties, whose teeth are wearing rapidly, with the bite closing, the anterior teeth shortening and the appearance impaired, had the bite opened one-eighth inch (patient's statement), jackets being applied to the anterior upper teeth, but left out of contact with the lower anterior teeth by about one-sixteenth inch. Occlusal inlays were applied to the posterior teeth, lower and upper, to hold the bite open. The individual inlays and jackets exhibited craftsmanship of the highest order. As a result of the treatment, at the end of three years, the bite was closed so that the incisors were in contact, and three beautifully inlayed lower molars were so loose that it is doubtful whether anything could be done to save them.

In this case, the dentist had evidently learned from experience that opened bites do close. This reasoning prompted him to try to avoid fracture of the anterior jackets by allowing them to clear their antagonists. A lesser degree of opening with the change in dimension so made that the anterior teeth would be in contact in masticating excursions, instead of free, would have added to the whole picture the resistance of the bone investing the roots of the anterior teeth, and this might have been enough to delay or prevent much closure. As it was, the entire resistance of bone to muscle force was reduced by confining the resistance to that of the bone investing the posterior teeth only; hence, the bite unquestionably closed sooner, and perhaps farther, than would otherwise have been the case.

You recall that the first case cited was also treated without providing for functional contact of the anterior teeth. Nature later provided this contact by intruding the posterior teeth, so that the incisors made normal contact.

3. A woman in her late fifties or early sixties had teeth missing apparently owing to periodontoclasia. The bite was opened and the mandible advanced (?) by bridge and splinting reconstruction involving the entire remaining complement of lower teeth. Treatment extended over a period of several years. All abutment teeth are so loose that if the gold structure surmounting them were removed, the teeth would be too loose to serve any useful purpose. The "restored" occlusal surfaces show that the occlusion developed on an arbitrary machine was badly out of harmony with the patient's natural muscular action. As a result, the patient is constantly very uncomfortable dentally and very nearly distracted. The dentist who made the restoration is on record as saying that this patient is one who could never be made dentally comfortable, and the dentist is right so long as she wears his stilted, maloccluded devices.

4. This was a case in which bone resistance was greater than muscle force. It was not a splint case, but is cited to show that Nature has her whims, and when she has determined on her plan, dentistry may be presuming too much to essay naively to change it.

The patient was in the middle forties. There was occlusion of the second and third molars, but no occlusion of the teeth anterior to the molars mentioned. Orthodontia was tried in early childhood, but occlusion of the anterior teeth could not be effected. It is my belief, from long observation, that Nature may (and I say may with reservations) shorten muscles, but she rarely, if ever, increases their functional length. Increasing the elevation of occlusal surfaces of human teeth for the purpose of increasing the vertical dimension of the human face would re-

quire that Nature increase the functional length of muscles of the masticating apparatus. Failures in bite-opening operations are definite proof that this has not been effected in these cases, and all indications are that it cannot be expected to occur, when the shortening of the vertical dimension occurs as a result of Nature's seeking a balance between muscle stress and bone resistance. Therefore, we will best succeed who try to find out Nature's restrictions and fit our restorative efforts to her present plan. Let us not lose sight of the fact that the habits of mastication and bone resistance are individual; that either may be stronger than the other in a given individual; that the conformation of the lower third of the face is the result of a balance between the muscles and the bone structures activated by these muscles. If bone resistance decreases and muscle force remains constant, we may expect a shortening of the facial dimension to effect balance. If, from physiologic or pathologic change, the muscle force should increase or its period of activity in applying force to the teeth be increased *per diem,* we may expect an adjustment that will shorten the lower third of the face, if the bone resistance remains at the previous constant.

Denture restorations occupy more than half of my office hours, and in this field the greatest difficulty is met when bite-opening restorations are attempted. So true is this that I am constantly on the alert to avoid the very procedure which those advocating restoration of lost facial dimension attempt. The lower third of the face cannot often be restored to any ideal standard. The appearance of this section of the face is Nature's answer to the necessity for muscle-bone balance. The ease with which immediate dentures are worn when the natural vertical dimension is accurately copied is further proof of the wisdom of avoiding bite-opening procedure beyond that permitted by the natural functioning length of the muscles of mastication, as related to the resistance of the alveolar bone to muscle tension in function for a given individual.

The foregoing remarks concerning full denture practice should not be construed to mean that I do not reconstruct immediate dentures when ridges settle, in an effort to maintain the original facial dimension. In this field as in operative dentistry, however, I believe it better to work with Nature and maintain the condition that existed when the patient had the natural teeth *in situ.*

John V. Mershon, in 1935, read an illuminating paper before the Academy of Stomatology of Philadelphia.[1] It is recommended that those who are thinking of involving themselves in bite-opening procedures consult this article. I quote:

> The muscles of mastication can tolerate without strain only a certain bulk between mandible and maxillae. If abnormally long artificial teeth be inserted, the bone beneath them will be resorbed until the muscles have been relieved of all strain. The length of the muscles controlling the mandible determines the extent of the eruption of the teeth, because nature will not tolerate any strain which can be eliminated by means of an accommodation of the parts involved. The nervous system is seriously upset as the result of abnormal muscle pull. This is true in curvature of the spine, in fallen arches, in strained muscles of the eyes and in many other instances. For the same reason, it is true that any attempt to open the first class of closed-bite beyond the point at which all the muscles are at rest will result in the same detrimental physical reaction in the patient because of abnormal muscle strain.
>
> I have often heard patients who had artificial teeth or other mechanisms placed with the object of opening the bite complain of indescribable discomfort. This was nothing but muscle strain resulting from the attempt to open a true closed-bite. The shortening of the profile from nose to chin is evidence of nature's ingenuity in preventing a strain upon the muscles of the jaws.

If you and I were able to accurately

1. Mershon, J. V.: *J. New York Acad. Dent.,* 2:137, December 1935.

measure and record the degree of resistance of alveolar bone to a given degree of strain, and if you and I could determine the degree of strain developed in function by the musculature of the masticating apparatus for each and every degree of bite opening, we might arrive at a formula for treatment of such cases as would be benefited by increase of the vertical dimension of the lower portion of the face. Pending the time when such information can be obtained, shall we attempt to intrude on Nature's plan, or shall we be content to maintain the status quo for those who, through biologic dysfunction or lack of dental treatment, have fallen on such sad days? In fairness, the possible disadvantages as well as the hoped-for advantages of changing the vertical dimension of the lower third of the face should be frankly discussed with the patient, who should be advised of the risk so that choice may be made between maintaining the status quo and the risk of injuring dental remnants, if radical procedure is attempted.

PRESENT STATUS OF PORCELAIN BRIDGEWORK

By William A. Squires, D.D.S., New York City

PORCELAIN bridges, as well as porcelain inlays and porcelain jackets, are not new in American dentistry. I am not a pioneer in this special field of restoration, but for twenty-nine years I have been rather active in dental ceramics and for the past thirteen years I have devoted considerable time to the study of the physics and chemistry of ceramic materials. In view of the recognized esthetic advantages of porcelain as a material for certain dental restorations and its increasing demand, it is a matter of considerable importance to ask ourselves the following questions:

1. Is porcelain a suitable material for bridge construction in favorable cases?

2. Have porcelain workers perfected the technic of bridge construction to a point where satisfaction in the finished product can be expected?

3. Is the technical skill required for porcelain bridge construction beyond attainment by the skilled general practitioner?

In attempting to answer these questions, I have attended meetings, made an extended trip to many dental offices and laboratories and corresponded with many dentists and laboratory technicians. The last project took the form of a questionnaire, to which further reference will be made.

In the course of making this investigation, I have been amazed to note the increasing popularity of this type of restoration even though dental ceramics, so far, has received little or no commendation from our institutions of learning. The information obtained during my country-wide travels all had a generous and sincere impulse; but the opinions received ranged from the overenthusiastic 100 per cent success to the dismal 100 per cent failure.

I was somewhat disappointed at some of the answers received, and, in particular, I could not quite reconcile myself to the contradictory statements regarding

(Read before the Section on Partial Denture Prosthesis at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

colors and the physical properties of ceramic materials.

At the end of my trip, I felt that I had gathered considerable information of general value, but it was so loose and scattered, that it had little or no constructive professional value.

On receiving an invitation to present a paper on dental ceramics before the Partial Denture Section of the American Dental Association, and having had this particular experience as a background, I decided to formulate a questionnaire with which to gather, as far as possible, a documentation of facts to present with my comments for your consideration.

The questionnaire was sent to 285 practitioners and dental laboratories throughout the country, selected partly from a list of personal contacts and partly from suggestions received. Eighty-two per cent of those approached answered the questionnaire; which goes to show the unusual interest and eagerness of the profession to cooperate in perfecting this type of restoration.

Fig. 1.—Carmichael principle in crown preparation.

Since an "ideal" restoration had to be visualized, and in order to bring the answers to a common denominator, a definite question was asked: From an engineering point of view, which do you prefer: (a) a porcelain bridge with a metal structure; that is, with the porcelain baked over it; (b) an all porcelain bridge with no metal, or (c) a thimble porcelain bridge with individual crowns. (Note the words "from an engineering point of view," and also that the preface of the questionnaire specified and limited the answers to "a two-tooth restoration only.")

The objective of the questionnaire was, primarily, to ascertain in what numerical degree professional men were interested in porcelain bridges and what type of restoration had a preference over others, and also to learn the opinion of the profession in reference to ceramic materials. An analysis of the answers to the questionnaire shows that the metal frame and thimble bridge were preferred by the enormous percentage of 93 per cent, as against 7 per cent for the all-porcelain type; that is, 58 per cent for the baked-in metal bar, 35 per cent for the thimble type and 7 per cent for the whole porcelain.

To comment at length on the questionnaire would, in itself, make an interesting paper. I shall limit myself, as we proceed, to a general report that you may draw your own conclusions, and center the thought in presenting a conception of a two-tooth porcelain restoration. However, at this point, I wish to present more facts in connection with the questionnaire, which I think you will be interested in, as the figures represent the opinion of men who have probably done the greatest amount of work in this field.

Question: *Which of the three following types of restorations would you be naturally or instinctively inclined to adopt?* (Note the words "naturally or instinctively" as compared to the "engineering point of view" which were previously employed in the question.)

1. *A porcelain bridge with a metal structure; that is, with the porcelain baked over it.*

2. *An all porcelain bridge with no metal.*

3. *A thimble porcelain bridge with individual crowns.*

Answer: Twenty-one per cent favored all porcelain; 50 per cent, metal frames, and 28 per cent, the thimble type.

Question: *Are you by nature inclined to sacrifice esthetics for strength or vice versa?*

Answer: Fifty-one per cent stated that they would sacrifice strength for esthetics.

Question: *Are you in favor of a metal baked-in rest, a porcelain rest or an inserted cemented-in metal rest?*

Answer: Eighty per cent preferred a baked-in metal rest; 15 per cent, a cemented-in metal rest, and 5 per cent, a porcelain rest.

Question: *Are you satisfied with the physical properties of the present ceramic materials as a whole? In your estimation, is the present range, or palette, of colors obtainable on the market today for porcelain restorations adequate for the needs intended? Do you find dental ceramic materials too translucent or not translucent enough, the fusing point too high or too low?*

Answer: Ninety-one per cent of the answers reported that the materials were not satisfactory for the work intended, because of colors, fusing point, translucency, etc. Three per cent found them perfect and claimed perfect results. Six per cent offered suggestions, but none of the 91 per cent who had objections offered a set of standards or of specifications.

In the field of dental metallurgy, we have had, for many years, dental alloys with definite physical properties, intended to be used for definite types of restorations, and we can now, thanks to the efforts of the manufacturers, construct dental appliances which are not only more scientific, but also render a more durable and esthetic service than was possible when, not many years ago, we used alloys made by rule of thumb.

What are the present physical properties of dental ceramic materials? What standards are employed in presenting them to the profession? As far as I know, and in my meager knowledge of ceramic engineering, they are still presented in the same containers, with the usual number of identification, in which I purchased them thirty years ago: no particular classification of colors, no range of vitrification, no coefficient of expansion, no standards of lumina of translucency, no definite technic, no nodule of rupture, no tensile strength, etc.

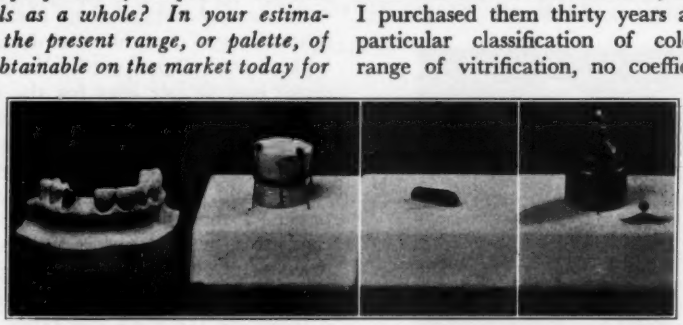

Fig. 2.—Left to right: Cast showing preparation; split plaster impression of preparation; wax pattern of preparation; metal casting of wax pattern and pattern for platinum-iridium band.

Everybody who practices ceramics in dentistry has had of necessity to develop his personal technic by trial and error, without any scientific guidance.

In recent years, certain investigators, whom I sincerely call unknown soldiers of civilization, have, unsung and unattached, done considerable work, particularly on manipulation of dental ceramic materials, but as far as classification of colors, and as to set, definite standards of physical properties, nothing, to my knowledge, has been done.

Jacket crowns, to be sure, as a whole, have been very satisfactory. It seems to me, however, that just because this particular restoration has been successful, the profession is taking for granted that we can, with the same process and materials, make other types of porcelain restorations although an entirely different set of physical properties are required for the ceramic materials.

Little is generally known of the heart-rending difficulties encountered in the enameling and sanitary-wear industries; and even though the enormous resources of science and ample funds for their development have been employed, some of the problems are far from being solved.

I do not wish to condemn or criticize, but, rather, hope to stimulate investigators in the field of dental ceramic materials and to make the profession more intelligently conscious of the problems of dental ceramics.

I feel certain that, eventually, when the proper interests and talent come together, it will be quite possible, with metallurgic aid, proper ceramic materials, adequate equipment and technic, etc., to develop ceramic restorations which will be satisfactory in a large percentage of cases.

I shall now consider some of the problems of porcelain bridge construction, as I see them.

When a two-tooth porcelain restoration is under consideration or is imperative, the condition with which we are confronted is, aside from function, primarily one of esthetics. In my opinion, neither the all-porcelain type nor the baked-in metal frame offers the esthetic values we seek.

In these two types of restorations, color, texture, inclination of the incisal angle and form of teeth may or may not be skilfully reproduced. Unfortunately, however, this particular technic invariably results in that "tacky" appearance at the contact point of the dummy and the jacket crown which detracts from the esthetic effect and which so distinctly characterizes these types of restorations.

As far as I know, there are no ways, means or adequate equipment with which to reproduce that soft, neat, natural contact-point and interproximal space which it is imperative to reproduce if we are to obtain the esthetic values desired.

Then, too, whether it be a porcelain bridge, a precision bridge or an ordinary rubber partial denture, the contact point of the artificial with the adjacent natural teeth is a feature sadly neglected in most dental restorations.

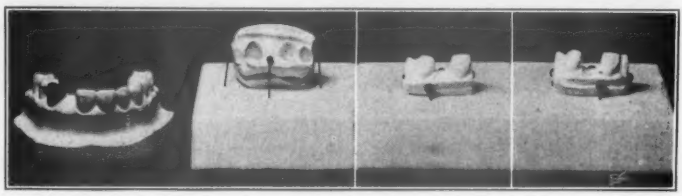

Fig. 3.—Left to right: Jacket crown built in wax for contour of dummy; split plaster impression of wax jacket crown and adjacent tooth; model of cristobalite; model of cristobalite enlarged and varnished.

Thimble bridges, on the other hand, being made of two separate units, if skilfully constructed solve, in a measure, the problem of the contact point. Unfortunately, however, certain types of teeth, and in particular the ovoid type, invariably show gold interproximally, and besides, owing to the metal construction underneath, very often the color of the prosthesis is seriously affected.

The bridge that I wish to present offers, in my estimation, the advantages of

the metal frame, plus the features of the contact point of the thimble type, thus helping to reconcile the 51 per cent of the men who in answering the questionnaire said that they were willing to sacrifice strength for esthetics, and compromising with the others, who demanded strength.

However, before introducing the technic of this restoration, I wish to say that there is not (as far as is known today) a chemical union between a baked-in platinum-iridium frame and the porcelain.

This statement refers only to the present popular conception of a bar of platinum-iridium embedded in the body of a dummy and attached to the metal of the jacket crown.

From an engineering point of view, what really strengthens a two-tooth porcelain bridge with a baked-in metal frame is not the metal bar or the metal spur that supports the dummy, but the platinum-iridium band of the jacket crown, and the engineering of the preparation, that protect the porcelain during the torque action in function. Experience has proved that most fractures of a two-tooth porcelain bridge and, in many cases, even of bridges with a baked-in metal frame, invariably occur, not in the body of the dummy, but in the jacket crown, and usually beyond the contact point.

The general conception in the construction of jacket crowns is the greater the bulk of porcelain, the greater the strength of the jacket. In my experience, this has not proved to be exactly true. The fracture is caused by the torque action during function on the anchorage unit, splitting the jacket crown. The same principle of engineering applies, only to a much greater degree, to a two-tooth porcelain restoration, and, therefore, the principles of engineering which conform with the laws of stresses should be strictly followed in the construction of the metal portion and the preparation of the abutment tooth so designed as to support the necessary load under function.

Experience, which in the last analysis is the basis of all scientific research, has proved beyond a doubt that, bulk for bulk, as compared with other materials, there is more than sufficient strength in a mass of porcelain to withstand the stresses of a two-tooth porcelain bridge without the aid of a metal bar.

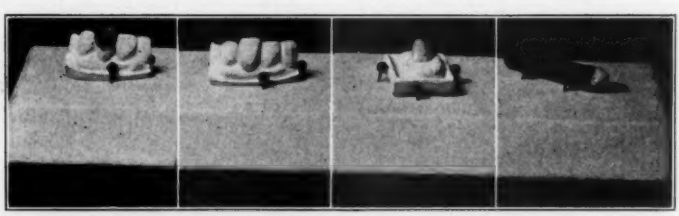

Fig. 4.—Left to right: Dummy built up; first bake on model to 1750°F.; dummy fused; dummy ground in and fastened to diamond cement for polishing on lathe.

Since this particular restoration is made in two pieces and "soldered" with a lower fusing ceramic material, some may question its strength.

It is generally thought that a lower fusing porcelain body is weaker than a high fusing dental porcelain, but that does not seem to be the case. Everything being equal, a low fusing porcelain body, if fired at the proper temperature, will undergo the test of tensile strength, impact and thermal test as favorably as higher fusing porcelain.

The real reason that lower fusing porcelain is considered to be weaker is the fact that the range of vitrification is much shorter and, consequently, it is more easily overfired, and the physical proper-

ties of the porcelain body are altered or destroyed.

There is the same analogy in this process as there is between the 14-karat and 22-karat solder. The solder unites with the metal to form a solid solution of metals. In our case, the borosilicates of the low fusing porcelain combine with the double alumina silicates of potassium of the higher fusing body to form the solid solution of boro-alumina silicates at the point of junction.

To summarize the technic for this restoration, the high-lights are as follows:

A Carmichael principle in the preparation of the abutment to counteract the force of torque in function.

The interdental spaces, which are only obtainable with this particular technic.

The contact point and character of tooth-form that it is possible to reproduce.

The restoration of two separate units by which strains in the porcelain materials are eliminated.

For this particular technic, it is absolutely necessary to have a very strong metal dye on which the platinum-iridium matrix is adapted. To that end, procedure is as follows:

A split plaster impression of the preparation is made. After removal of the metal preparation from the impression, casting wax is poured into the mold. Care should be taken to have the plaster mold quite warm and wet, lest the casting wax stick to the sides of the mold. The casting wax actually shrinks several thousandths inch; in other words, it is several thousandths smaller than the original amalgam dye preparation. This does not, however, make any particular difference as the final swaging is done on the amalgam dye.

After obtaining the metal dye, a pattern of 0.005 tinfoil is made, and from this pattern a piece of 15 per cent, 0.004 platinum-iridium is adapted to the metal dye. The metal dye is made of a hard gold alloy, which will withstand the rather rough hammering and tooling necessary to adapt such a stiff metal as the 15 per cent.

In making this coping of platinum-iridium, it is better to leave the ends of the band free; that is, not solder them together, but leave the two ends of the band pattern free to follow the pulls during the process of adaptation. After the platinum-iridium coping has been swaged on the hard metal dye, a piece of 0.030 15 per cent platinum-iridium wire is adapted to the lingual portion on the shoulder on the metal dye. It is advisable to tack with a tiny bit of platinum solder and be sure to have the square wire well adapted to the shoulder of the Carmichael preparation. After the square wire has been soldered to the platinum-iridium coping, it is put on the amalgam preparation and a piece of paper, 0.002, is placed between the amalgam dye and the platinum-iridium coping and then swaged. The object of putting the 0.002 thickness of paper

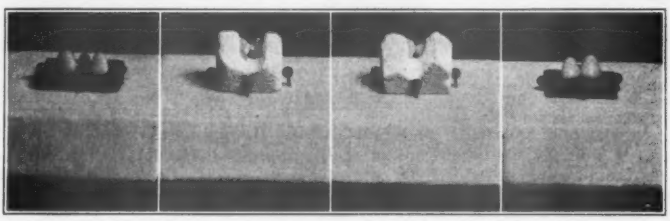

Fig. 5.—Left to right: Jacket crown and dummy ready for assembling; first stage of baking on refractory investment; second stage of fusing (or soldering) dummy and jacket crown; completed case.

between the preparation and the coping is to make allowance for the 0.001 thickness of the platinum matrix which goes under the platinum-iridium coping.

At this point, after the platinum-iridium coping is well adapted, swaged and soldered together with the platinum-iridium wire, the contact point of the teeth is located, where the platinum-iridium spur is then soldered to the coping. After that has been done, the usual 0.001 platinum matrix is made over the preparation and the platinum-iridium coping put over the dummy is to be built. This impression is poured in crystobalite investment material. Cristobalite material is selected because it affords a very smooth model and one of sufficiently high refractoriness that the dummy can be built on it.

After the refractory model is obtained, it is scraped in order to increase the space where the dummy is to be built to allow for the shrinkage of the porcelain.

The dummy is built upon the cristobalite model with the usual accepted porcelain manipulation, and brought to

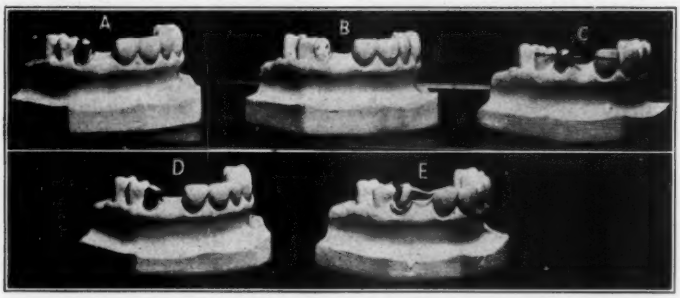

Fig. 6.—A, one one-thousandth platinum matrix. B, platinum-iridium coping, four one-thousandths (15 per cent) platinum-iridium. C, platinum-iridium coping with platinum-iridium spur and platinum-iridium shoulder. D, cast platinum-iridium coping. E, skeleton for torque bridge.

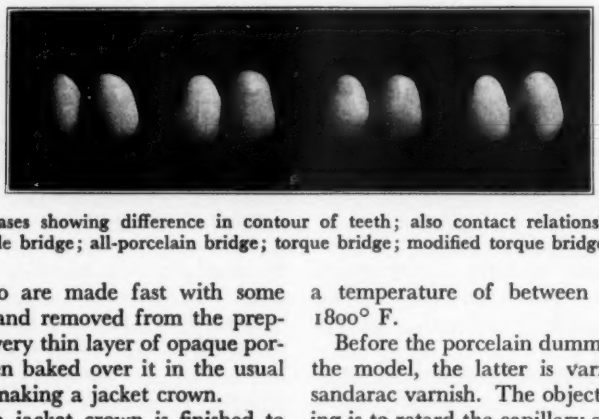

Fig. 7.—Cases showing difference in contour of teeth; also contact relationships. Left to right: Thimble bridge; all-porcelain bridge; torque bridge; modified torque bridge.

it. The two are made fast with some sticky wax and removed from the preparation. A very thin layer of opaque porcelain is then baked over it in the usual manner of making a jacket crown.

When the jacket crown is finished to proper contour, etc., a sectional impression, either in plaster or in modeling compound, is taken with the jacket crown in position to include the other teeth where a temperature of between 1750° and 1800° F.

Before the porcelain dummy is built on the model, the latter is varnished with sandarac varnish. The object of varnishing is to retard the capillary action of the investment on the porcelain dummy.

After the dummy is fired on the model at 1750° or 1800° F., it is removed from the cristobalite model. Corrections are

made if necessary, either by adding or by modifying to the proper contour. The dummy is then embedded in a mass of silica sand which has been previously mixed with a small amount of gum tragacanth. The object of adding a small amount of gum tragacanth to the silica sand is to impart a certain amount of plasticity to the sand. The biscuit dummy can then be adapted on the mass of sand and made to rest more comfortably on the refractory support made by the sand, without putting any strain on the dummy.

The dummy is brought to a maturing point anywhere between 2340° and 2400° F., according to the technic of the operator and other variable circumstances. After the dummy is baked, it is ground in position to the proper contour as to pitch of the incisal angle, gum relation and contact point, etc.

The dummy is then polished. In order to best hold the dummy during the process of polishing, it is made fast, by heating, to a piece of diamond cement. Care should be taken to keep both jacket crown and dummy slightly fuller in size in order to have a snug contact point when the bridge is assembled.

After the jacket crown has been finished and the dummy completed and polished, the latter is drilled at the point of contact with the jacket crown to make a recess for the platinum-iridium spur of the jacket abutment crown, which embeds itself in the body of the porcelain dummy. When both jacket crown and dummy have been carefully brought down to the proper size as to contact, etc., a small amount of 1700-degree porcelain of the proper color or colors is mixed with a small amount of gum tragacanth and inserted in the recess of the dummy. Both jacket crown and dummy are brought into the proper relation on the model and let dry until the tragacanth and the porcelain are thoroughly dry.

To make more certain and to facilitate the removal of the bridge from the model, a small piece of wood or metal is fastened to the dummy and jacket crown, and after it has been removed from the model, it is invested in standard investment material, both jacket crown and dummy being covered fairly well and the portion of the bridge where additional 1700-degree porcelain is to be added left exposed. After the necessary drying and gradual heating of the investment, it is put in the porcelain furnace and fired at 1500° F.

At 1500° F., there is an incipient vitrification of the 1700-degree porcelain, and this affords an opportunity, if necessary, to add more porcelain where needed. Subsequently, it is put back in the furnace and fired to the maturing point of 1700-degree porcelain.

COLLOIDAL IMPRESSION MATERIALS*

By E. W. Skinner, Ph.D., and W. R. Kern, D.D.S., M.S.D., Chicago, Ill.

THE use of hydrocolloid impression materials has become quite extensive in certain branches of dentistry, particularly in the field of partial denture prosthesis. The particular excellence of these materials lies in their elasticity, and, consequently, their ability to reproduce undercuts and dovetails, which may be very troublesome in the withdrawal of an impression which is made with any of the ordinary materials.

Many claims have been made by manufacturers as to the accuracy of the resulting cast or model constructed from an impression made with these materials. As nearly as can be determined from the literature which sets forth such claims, the statements are based upon experiments wherein the cast or model material is poured into the impression immediately after it has been obtained. However, the dentist is not always in a position to manipulate the material in this manner.

As the essential ingredient of these materials is a hydrocolloid (agar-agar), considerable change in dimension might be expected over a long period of time. A hydrocolloid or, as it may be more properly termed, a colloidal gel exhibits the property of swelling or contracting according to the vapor pressure of its surroundings. For example, if the impression is allowed to remain in an atmosphere of less than 100 per cent humidity, it will lose water and contract. On the other hand, if the material is placed under water, it will imbibe water and swell, provided, of course, it is not already saturated with water at the temperature involved. The amount of water necessary for a condition of equilibrium is dependent on the temperature. In general, the gel will lose water when the temperature is raised, and, conversely, it will imbibe it when the temperature is lowered. The latter fact probably explains why dimensional changes are not found in the material when it is changed from mouth to room temperature; i.e., the imbibition counteracts thermal contraction, and conversely.

Table 1.—Hydrocolloid Impression Materials: Trade Names and Names of Manufacturers

Trade Name	Manufacturer
Surgimold	Surgident, Ltd.
S. S. White Elastic Compound	The S. S. White Dental Mfg. Co.
Plasticoll	Lee S. Smith and Son Mfg. Co.
Deelastic	Thos. J. Dee and Co.
Elasticol	Goldsmith Bros. Smelting and Refining Co.
Dentocoll	The L. D. Caulk Co.

The present investigation is concerned with the possible dimensional changes which may occur during normal manipulation by the dentist, as described. Also, certain experiments on elasticity are reported, but they should be regarded as work preliminary to a more extensive investigation of the mechanical properties of these materials.

All materials investigated were commercial products purchased from a supply

(Read before the Subsection on Dentistry of the American Association for the Advancement of Science, Atlantic City, N. J., December 28, 1936.)

*Data submitted in a thesis written by Dr. Kern in partial fulfilment of the requirements for the degree of master of science in dentistry at Northwestern University Dental School.

house. In all experiments, the directions of the manufacturers were standardized, and all specimens were prepared in strict accordance with such directions. The trade names and manufacturers of the materials are given in Table 1. The names are not listed according to the order of the code letters employed in the presentation of the data.

DIMENSIONAL CHANGES IN AIR OF LESS THAN 100 PER CENT RELATIVE HUMIDITY

In the first experiment to be described, the rate and magnitude of the dimensional changes in air of a relative humidity of from 32 to 47 per cent were investigated. Each material in turn was manipulated according to the directions of the manufacturer, and poured into a tinfoil-lined trough. Markers were placed 330 mm. apart, and any ensuing dimensional changes were observed with two microscope comparators, each of which was focused over a marker. In each case, the fiducial reading was obtained in two minutes after the pouring of the material, after which readings were obtained every five minutes for one hour. At the end of one hour, the specimen was covered with water and the readings were continued for three hours. The data presented in Table 2 and Figure 1 are the average of two or three trials with different specimens of the same material. As may be noted, every material shrank when exposed to the air. However, the amount of shrinkage varies greatly between materials A and B and the remainder. The only known difference in composition is that materials A and B contain a fibrous material, presumably cellulose, whereas the others do not.

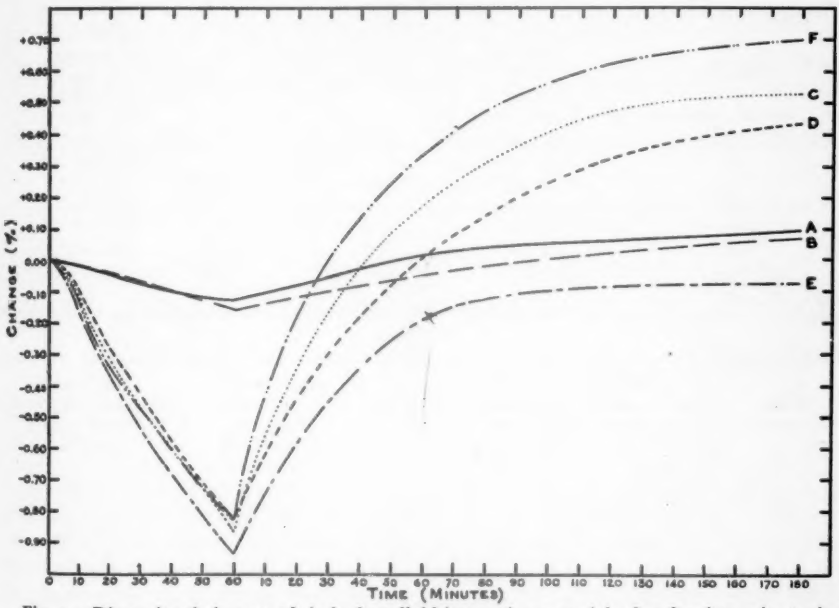

Fig. 1.—Dimensional changes of six hydrocolloid impression materials, first for sixty minutes in air (relative humidity 32-47 per cent), and subsequently immersed in water for three hours.

As shown by Figure 1, the rate of shrinkage of the non-fibrous materials is much greater than that of materials A and B. Furthermore, none of the materials are even approaching a condition of

equilibrium, according to the graphs. It was impossible to extend the readings for longer than an hour because of the warpage which occurred.

After the materials were immersed in water, all but one of them expanded beyond their original dimensions. The amount of this expansion, which is given in the fourth column of Table 2, was obtained by subtracting the figures in column two from those in column three. the trough was enclosed above a water bath. A plateglass cover was sealed to the bath with wax. The microscopes were focused as before, but through the glass. It was necessary to insert a rod to which cotton swabs were attached to clear the glass of water droplets, which constantly formed beneath the objectives of the microscopes. A temperature of 24°C. (75.2°F.) was employed during the actual observations.

TABLE 2.—LINEAR CHANGES IN AIR (RELATIVE HUMIDITY 32-47 PER CENT) AND SUBSEQUENTLY IN WATER

Material Code Letter	Shrinkage in Air Per Cent	Subsequent Expansion in Water Per Cent	Final Length in Comparison with Original Dimension Per Cent
A	0.123	0.197	+0.074
B	0.158	0.228	+0.071
C	0.862	1.394	+0.532
D	0.846	1.280	+0.434
E	0.954	0.872	−0.073
F	0.831	1.524	+0.694

TABLE 3.—LINEAR CHANGES IN AIR (RELATIVE HUMIDITY 100 PER CENT) AND SUBSEQUENT CHANGES IN WATER

Code Letter	Shrinkage After Three Hours Per Cent	Shrinkage After Subsequent Elapsed Time Hours	Shrinkage Per Cent	Subsequent Expansion in Water in Three Hours Per Cent	Final Length in Comparison with Original Length Per Cent
A	0.054	72	0.241	0.303	+0.095
B	0.047	68	0.226	0.378	+0.152
C	0.278	24	0.391	0.749	+0.358
D	0.234	24	0.423	0.965	+0.535
E	0.236	54	0.458	0.388	−0.070

A plus sign indicates an ultimate expansion, and a minus sign a contraction. As may be noted, materials A, B and E are the best as far as the recovery of the original dimension in water is concerned. The errors involved are negligible in the case of these three materials.

DIMENSIONAL CHANGES IN AIR OF 100 PER CENT RELATIVE HUMIDITY

The same apparatus was employed as in the previous experiment, except that

Owing to the fact that considerable time was required for the sealing of the glass cover to the bath each time, seven minutes had to be allowed between the time of pouring the specimen and of obtaining the fiducial reading. However, the changes occurred slowly in this case, and it is doubtful whether this delay was of any practical consequence. Readings were obtained every five minutes from the fiducial readings throughout a period of three hours. Each specimen was then

allowed to remain at room temperature in the humidor previously described for periods ranging from twenty-four to 100 hours before immersion in water. After immersion in water at 24°C. (75.2°F.), readings were again taken at five-minute intervals, over a period of three hours.

The data presented in Table 3 are the average of two or three trials for each material. As the times which elapsed between the final three-hour reading at 100 per cent relative humidity and the first reading when totally immersed were different for different trials, it was impracticable to obtain graphs which could be averaged, and space does not permit the publishing of the individual graphs for each trial.

A contraction occurred in every case, although materials A and B exhibited contractions which were definitely less than the others. The contractions were much slower in rate than in the previous experiment. As before, the last column in Table 3 indicates the amount that the specimens recovered after immersion in water.

MECHANICAL PROPERTIES

The mechanical properties of these materials were studied under compression by means of a specially designed plastometer. Cylindrical specimens of 29.6 mm. diameter and of 20 mm. altitude were prepared. All specimens were "annealed" at room temperature in an atmosphere of 100 per cent relative humidity for a period of not less than twenty-four hours, in order that subsequent tests would not be affected by the dimensional changes which occurred in the similar environment previously described. All tests were carried out at room temperature in an atmosphere of 100 per cent relative humidity.

The plastic flow of these materials was tested under an arbitrary static load of 10.2 gm. per square millimeter (3 pounds per square inch) for an arbitrary time of fifteen minutes. The results are given in Table 4. The flow was found to be logarithmic in character, and the curves are shown in Figure 2.

In order to determine a possible stress-strain relationship, specimens were loaded progressively at forty second intervals until fracture occurred. One-half kilogram incremental loads were first employed, but it was soon found that the excessive flow over the time required for such loading made the results too inconsistent. Subsequently, 1 kg. loadings were used. Even under these conditions, the location of a proportional limit could be obtained only by neglecting as much as 20 per cent of the lower portion of the stress-strain curve. A typical stress-strain curve is shown in Figure 3 for material D. The compressive properties as the average of four or five trials with each material are given in Table 4.

Table 4.—Compressive Properties and Plastic Flow

Code Letter	Proportional Limit		Maximum Flexibility (Mm./Mm. or In./In.)	Crushing Strength		Flow in Ten Minutes Per Cent	Flow in Fifteen Minutes Per Cent
	(Gm./Mm.²)	(Lb./In.²)		(Gm./Mm.²)	(Lb./In.²)		
A	14	4.1	0.06	30	8.7	0.56	0.70
B	21	6.1	0.16	26	7.6	0.99	1.24
C	22	6.5	0.12	25	7.3	0.62	0.85
D	25	7.3	0.14	29	8.5	0.75	1.02
E	11	3.2	0.08	16	4.7	1.55	2.16
F	23	6.7	0.17	24	7.0	1.10	1.41

CLINICAL SIGNIFICANCE

Most of the phenomena connected with the dimensional changes incurred can be

explained by the action of the gel in attaining equilibrium with its surroundings as previously described. As might be expected, the curves in Figure 1 indicate a shrinkage for all the materials. Obviously, the impression must be exposed to the air at least during the inspection after withdrawal from the mouth. As shown in Figure 1, all the materials except A and B shrink rapidly as the water content evaporates into the room. As previously mentioned, the chief reason for the use of these materials is their accuracy in comparison with plaster of Paris and modeling compound. If the plastic flow of the modeling compound is disregarded, the minimum error incurred with the latter two impression materials may be estimated as 0.3 per cent. Inspection of Figure 1 indicates that the impression with a hydrocolloid cannot be exposed to the air for longer than from fifteen to twenty minutes without exceeding the error incurred with the other materials.

Materials A and B each exhibit a very slight contraction up to an hour. As far as is known, these materials differ essentially from the others only in that they contain fibers which are evidently partially effective in the prevention of contraction during the time of observation.

The question may be raised as to

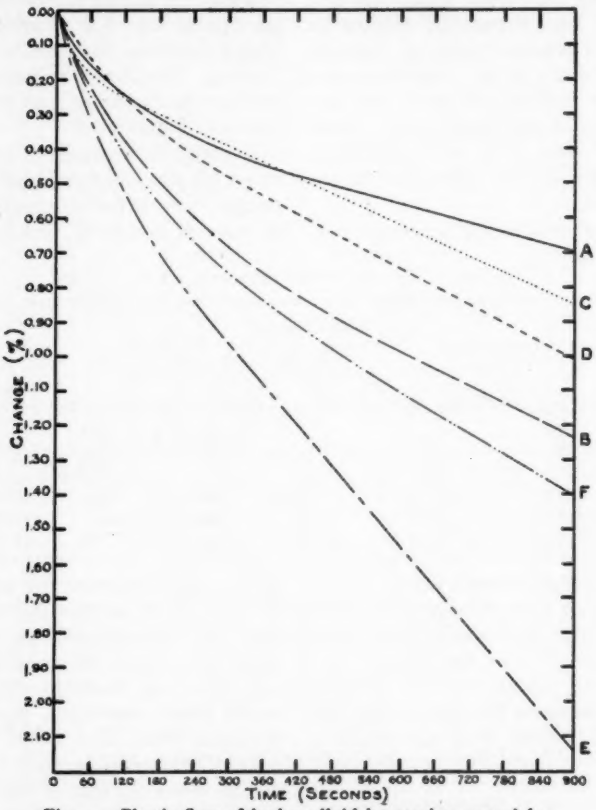

Fig. 2.—Plastic flow of hydrocolloid impression materials.

whether a partly dried impression will recover if it is immersed in water. As proved in Figure 1, materials A, B and E do exhibit a recovery sufficiently accurate for practical purposes, but, as may be observed, the remaining materials expand considerably beyond their original size. When the material is confined in a tray, such an expansion might produce a serious distortion, particularly in the case of a tray for the complete upper arch.[1] According to theoretical considerations, it may be assumed that the materials which expanded beyond their original dimensions were not in equilibrium for room temperature when they were poured from the mixing syringe; i.e., they contained insufficient water. This lack of water content may possibly be accounted for by the fact that considerable evaporation may have occurred during manipulations at the higher temperatures. As a result, the subsequent imbibition replenished the water to equilibrium conditions, and the volume of the material became greater than its original volume. That such may be the explanation is borne out by the data obtained with material E. The mixing syringe was not employed in softening this material: it was boiled twelve minutes in the original closed tube and placed in the trough without further manipulation. No increase in volume occurred, since no evaporation took place during the softening of the material.

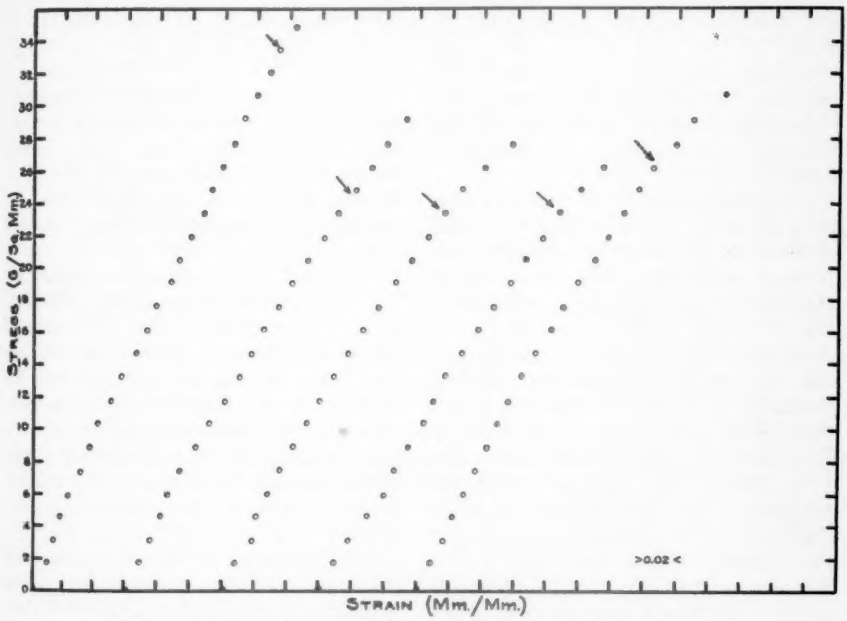

Fig. 3.—Compressive stress-strain curves for hydrocolloid material D.

Some dentists place the impressions in a humidor of some type and send them to a laboratory. At least one manufacturer instructs the laboratory technician to immerse the impression in water "overnight." The results of such treatment are given in Table 3. Again, if materials A, B and E are eliminated, such a treatment is apt to introduce a noteworthy error. The contraction observed in the humidor is difficult to account for, unless it is due

to a lack of circulation of the air about the specimen, a condition which might cause variations in the humidity. At any rate, subsequent immersion in water caused a condition which is similar to that shown in Table 2 and Figure 1. It is noteworthy that the figures given in the last columns of Tables 2 and 3 are of similar magnitudes. The reason for the occurrence of the expansion is evidently the same in the two cases. Again, it may be concluded that the presence of fibers in the materials is possibly beneficial from the standpoint of the maintenance of form.

In any event, the careful prosthetist will pour the cast or model as soon as possible after taking the impression. In this manner, he will obtain the utmost in accuracy.

Any comparisons to be made between these materials and modeling compound as to plastic flow must be somewhat conjectural until more data are available. However, a study of Table 4 and Figure 2 is of interest. The American Dental Association Specification No. 3[2] requires that no impression compound shall flow plastically more than 2 per cent when a cylinder of the material 10 mm. in diameter and of 6 mm. altitude is subjected to a load of 200 gm. (25.5 gm. per square millimeter) for ten minutes at 35°C. (95°F.). In the present experiment, a much larger specimen was employed, the unit stress during flow was less than half as much and the temperature employed was approximately 10°C. (18°F.) lower than the conditions specified. It is therefore probable that the plastic flow of these materials is greater than the maximum amount allowed by the American Dental Association specifications for impression compounds. However, because of the great difference in the rigidity of the two types of impression materials, it is doubtful whether such a flow is manifested clinically to the same degree in the case of the hydrocolloidal materials.

Very little can be said at the present time regarding the clinical significance of the remaining physical properties. Presumably, the greater the maximum flexibility, the more efficiently the impression will withdraw from undercuts without permanent distortion. It should be noted that all of the materials are very nearly of the same strength except E, which appears to be poor mechanically in every respect. It is of interest to note that the presence of fibers exhibits no consistent effect whatever on these properties. This fact is in contradiction to the prevalent belief that fibers increase the strength.

SUMMARY AND CONCLUSIONS

Six commercial hydrocolloid impression materials have been examined for dimensional changes which may occur under manipulations normally employed by the dentist. Preliminary experiments on the mechanical properties of these materials are also reported.

The conclusions reached are as follows:

1. These materials are very sensitive to changes in humidity. The accuracy of mouth reproduction which is claimed for these materials can be obtained only by pouring the cast or model as soon as possible after obtaining the impression.

2. A soaking of the impression in water before pouring the cast or model is contraindicated for at least three of the materials.

3. The presence of fibers in the material is an aid in the prevention of dimensional changes due to changes in humidity, but it is of no apparent value in the enhancement of mechanical properties, as far as such a conclusion is justified by the data presented.

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RADIOLOGY OF THE TEMPOROMANDIBULAR ARTICULATION WITH CORRECT REGISTRATION OF VERTICAL DIMENSION FOR RECONSTRUCTION

By T. W. Mayes, D.D.S., Cleveland, Ohio

IN the past five years, or perhaps longer, many valuable data and many essays pertaining to the temporomandibular articulation have been published in both the medical and the dental literature.

The time is most opportune to present the problem of temporomandibular articulation as a challenge to those members of the dental profession whose knowledge and technical skill permit them to be satisfied with the mere filling of cavities and spaces in the partial and full denture construction for the layman who places his trust in the average dentist. When such cases are completed, the deformities existing in the temporomandibular joint are perpetuated, thereby causing pain, deafness, disturbed function and eventual destruction of the joint. Nor must we overlook the introduction of traumatic occlusion, which hastens the loss of abutment teeth and resorption of ridges.

"Its chief function being mastication, the jaw is equipped with powerful muscles, the masseter, temporalis and pterygoideus internus, the function of all of which is to close the jaw. Acting as openers are the factors in the external pterygoid action, the action of the digastric muscle and the natural weight of the jaw. By complicated interaction, the jaw is fixed to aid in the act of swallowing; moves to a varying extent to accommodate the production of speech and adapts itself to great variations produced by densities of food, yawning, laughter, etc. The extent of normal opening of the jaw is controlled by the sphenomandibular ligament, the stylomandibular ligament and the short temporomandibular ligaments making up the capsule of the mandibular joint. The latter being weak at the forward aspect, extreme looseness sometimes permits the condyle to slide entirely beyond the articular eminence, producing subluxation of the jaw. The extent of closure of the jaw is determined by the occlusal contact of the teeth. Since most of the power of the muscles of mastication is applied to the posterior third of the jaw, most of the impact of chewing is taken by the molar teeth, very little being applied in the incisal region, as the mandibular joint acts only as a weak hinge or guide to this movement.

"It is not surprising, therefore, that, when molar teeth are missing or the vertical dimension of the jaw is abnormally reduced by shrinkage of the alveolar ridge beneath plates or by grinding away of the natural teeth, the mandibular joint should assume an unaccustomed burden from this region and much of its structure be destroyed. When this occurs, some of the force is thrown into the incisor region, but most of it is referred upward to the mandibular joint in direct

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line of the vertical dimension of the jaw. Proper regard for this function is the basis for testing the patient for the mandibular joint 'syndrome' and is the basis on which the dentist proceeds to restore the position of the jaw. (Fig. 1.)

"In a previous report,[1] it was suggested that anatomic conditions were responsible for the pain; i.e., (1) erosion of the bone of the glenoid or mandibular fossa, and impaction of the condyles against the thin bone separating them from the dura; (2) irritation by the uncontrolled movement of the condyles backward or mesially of

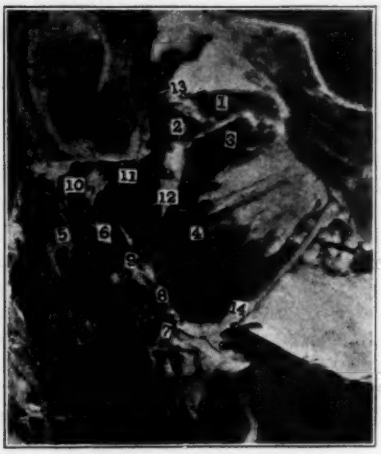

Fig. 1.

the auriculotemporal nerve, which passes intimately by the mesial side of the capsule between the condyle and the tympanic plate to distribution over the temporal and vertex region, and (3) production of reflex pain and sensory disturbance in the various connections of the chorda tympani nerve (Fig. 2), the condyle irritating it where it emerges from the tympanic plate at the mesial edge of the glenoid fossa through the petrotympanic fissure."[2]

In reference to deafness, C. E. Kinney, otolaryngologist, of Cleveland, Ohio, has grouped the disturbances leading to deafness in five classes: (1) otitis media; (2) otosclerosis; (3) advanced catarrhal deafness; (4) nerve deafness (senile), and (5) nerve deafness resulting from specific diseases, such as syphilis. According to the findings and records of most of the otolaryngologists, we may assume that a high percentage, in fact from 15 to 25 per cent, of all deafness results from the third class of disturbances and somewhat less from the fourth class. The actual cause as far as can be determined is attributable to two conditions, according to Dr. Wright, the late Dr. Prentiss and others:

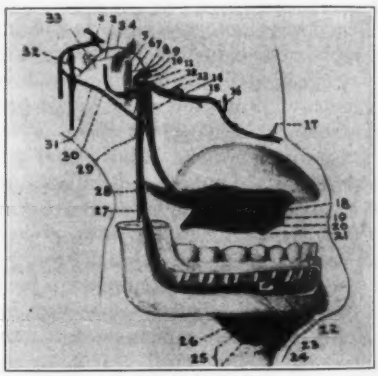

Fig. 2.

1. Reduction of the normal vertical dimension in the molar region, causing a relaxation of tissues and ligaments crowding against the eustachian tube and maintaining a partial or complete closure. Nature creates a form of suction in the act of swallowing which drains the posterior nasal and eustachian passageways. But by having a reduced vertical dimension, we have a crowding of ligaments and tissues against the eustachian tube and passageways, preventing proper drainage of that area.

2. An increase in vertical dimension in

the molar region, so that a normal physiologic and physical rest position is maintained, placing the ligaments and muscles back in a taut position, allowing no crowding against these passageways, and also creating a greater suction by the act of swallowing, drainage again assuming its normal function.

In charting the amount of deafness, an audiometer is used to record the extent of deafness of each ear and later a chart is made to show the improvement, if any, resulting from bringing the head of the lower jaws by the patient at a point opposite the first molar region.

After a careful review of the literature and technics for roentgenography of the joint, and a survey of the findings from a large number of skull measurements, both wet and dry specimens, it was decided to develop a technic which could be duplicated exactly with each consecutive or succeeding exposure, a technic which would give an accurate and exact duplication of the original roentgenogram so that reconstruction planes and cranial

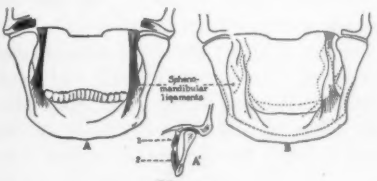

Fig. 3.

Fig. 5.

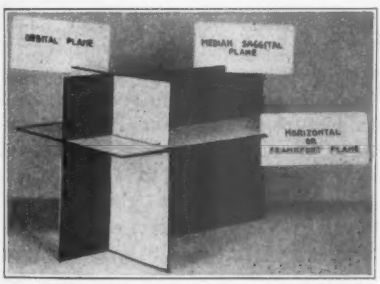

Fig. 4.

Fig. 6.

condyle to the normal position and increasing the vertical dimension with the aid of splints.

I wish at this time to suggest two basic fundamentals to add to the already existing knowledge of diagnosis and technic of reconstruction: (1) a definite standardized technic for the roentgenography of the temporomandibular joint, which is the first step in diagnosis for reconstruction, and (2) registration of the normal vertical dimension between the upper and lines could be duplicated and comparative measurements taken. Planes and cranial points were then adopted. The planes were to be known as the median sagittal, orbital and horizontal, or Frankfort, plane. (Fig. 4.)

The cranial points were to be known as nasion, prosthion, posion and occiput. After lengthy experiments and many exposures, it was concluded that once a patient's head was placed in a given position, an exact duplication of that position

would assure greater accuracy. In order to duplicate a position, it became evident that all planes and cranial points in this first position must be recorded with great accuracy and kept as a permanent record to be used in positioning the head for duplicate roentgenograms. To prove the accuracy of this duplication, several exposures of the same registration of a given position were made at different times under an exact technic of exposure. By making tracings and superimposing the tracing of one roentgenogram upon the tracing of another, the accuracy of the procedure was established.

In the past, a number of operators have experienced one great difficulty with

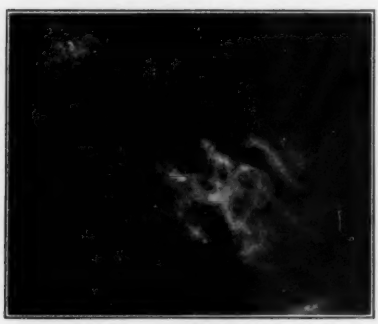

Fig. 7.

their roentgenographic technic of the joint; i.e., after the first exposure was developed and splints were placed on the teeth for a correction, they proceeded to recheck their case by roentgenograms of the joint with splints in position, and found that the recheck picture showed little or no change of the position of the condyle head in relation to the fossa. They therefore became somewhat skeptical regarding the value of roentgenograms of the joint for diagnosis. The reason for the above-mentioned error is the fact that the technic used does not permit a definite placing and registration according to planes and cranial points and a definite position of the tube according to the exact angle formed by the intersection of the line through the long axis of each fossa with the median sagittal plane, as is explained later. (Figs. 5 and 8, above, left.)

In order to differentiate between the normal and the abnormal positions of the head of the condyle in the fossa, the normal as given by Goodfriend and others was adopted; i.e., when the upper anterior surface of the head of the condyle rests near the lower posterior border of the articular eminence with the meniscus between serving as a cushion, we have the normal position of the joint.

Figures 6 and 7 show an enlargement of the roentgenograms of both right and left sides of a corrected case. Any position either anterior or posterior to the normal tends to deformity—either subarthrosis or dysarthrosis—and should be corrected by repositioning of the mandible. We also may have a lateral and rotated position of the condyle, which adds considerably to the deformity. If accuracy in recording the existing position of the head of the condyle and a clear picture of the extent of the deformity are desired, the rays should be directed through the long axis of the fossa. Where duplication is desirable, the extent of opening and also the exact extent of advancement of the mandible desirable in repositioning can easily be measured and used in reconstruction. This will check in the greater number of cases with the registration of the physiologic and physical rest position. Both condyle picture and registration of rest position are fundamental and necessary for all reconstruction.

Up to the present, all technics for roentgenography of the joint have used an average for the angle of the tube to the long axis of the fossa and median sagittal plane. With prosthion as a starting point, the tube is brought up on the head about 2 inches and placed at an average angle which varies from 15 to 20

degrees. Others determine a point 2 inches up and one-half inch posterior and then direct the tube at an angle of from 15 to 20 degrees. In the first technic, the ray bisects the long axis, which is not the angle desired. The second technic, going up and back, is more apt to direct the ray through the long axis of the fossa. The great objection to both is the average angle of tube to median sagittal plane.

Figure 8, above, right, skull 2019, shows a tracing accepted as normal; dentition having molar support, and lines through the long axis of each fossa intersecting the median sagittal plane at the same point. The two lines from the long axes intersecting the median sagittal plane are at the same point and the condyles show a normal position in the fossae.

Tracings of normal skulls permit these

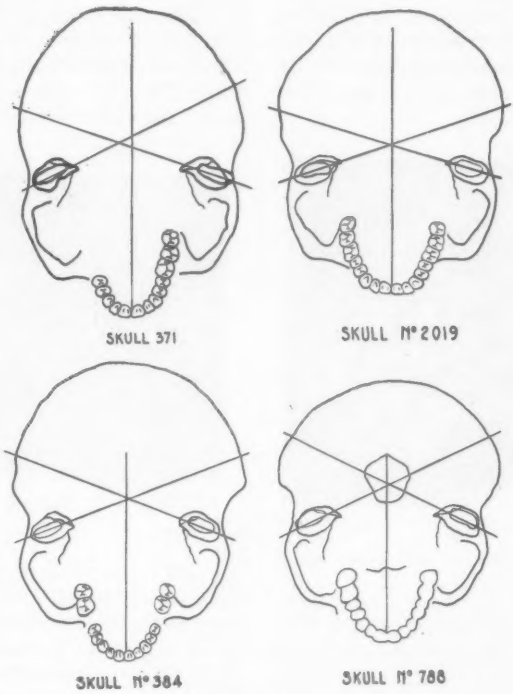

Fig. 8.

Hundreds of tracings of skulls have proved that the long axis bisects the median sagittal plane at various angles and therefore no average angle can be accepted for accuracy. Although an average of 17½ inches has been used, this is not exact enough where measurements are to be used for reconstruction.

deductions: 1. Where there is good molar support and the vertical dimension remains close to normal with little wear, if any, a line through the long axis of each fossa will intersect the median sagittal plane at about the same point. 2. If an exposure is made of the skull, a tracing made from that exposure showing lines

drawn through the long axis to the median sagittal plane will always give the exact angle for placing the tube in taking roentgenograms of the joint. Should the intersection with the median sagittal plane vary, the exact angle for roentgenographic work can be determined by a method described herein. Therefore, no average of this angle should be accepted for accuracy. This explains the error and difficulty experienced by most operators and with most technics to date.

A tracing of skull 384 (Fig. 8, below, left) shows the intersection of the long axis with the median sagittal plane at the same point. Although the first molars are lost, the vertical dimension is maintained by the other molar support, which shows no wear. The condyle heads are very close to normal position in the base of the fossae, which supports the thesis that if proper vertical dimension is maintained, joint relationship will remain normal or return to normal through correction.

Tracing of skull 788 (Fig. 8, below, right) shows considerably more wear on the occlusal surfaces, also a reduction in vertical dimension with the heads of the condyles going backward and upward in both fossae. Also, the two long axis lines intersect with the median sagittal plane at the same point; which shows that molar support on both sides, with considerable wear, results in a greater destruction in the joint area, but more nearly equal destruction on both sides.

Tracing of skull 371 (Fig. 8, above, left) shows a loss of molar support on the left side. When this occurs, lines through the long axes of both fossae do not intersect the median sagittal plane at the same point. Therefore, if the angle of the tube should be an average, and alike on the two sides, we would get a distorted picture on the one side, with no accuracy. This intersection of the line of the long axis of the fossa with the median sagittal plane also varies far more when molar support is lost on both sides. This brings up a very important point in roentgenology. Before right and left exposures are made for joint pictures, an exposure should be made of the individual or skull. (Fig. 9.)*

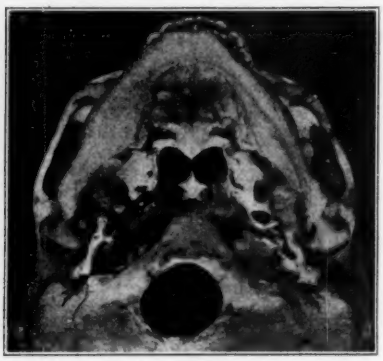

Fig. 9.

Fig. 10.

From Figure 10, a tracing was made, placing the median sagittal plane on the tracing from the point known as prosthion through to the center of the foramen magnum. Secondly, a line was drawn through the long axis of each condyle head, which automatically passes through

*Technic published in Eastman's Magazine of Radiology and Clinical Photography, 9, No. 3, September 1933.

the long axis of each fossa, and extends through the median sagittal plane. These angles of intersection (long axis of fossa with median sagittal plane) can be accurately determined and the exact angle for the tube adjustment for each side can be accurately made for both right and left sides of the condyle, average angles being thus eliminated and accurate measurements given for use in reconstruction work and duplication of joint pictures.

I may state at this time that an accurate device for the positioning and registering of any determined position of the

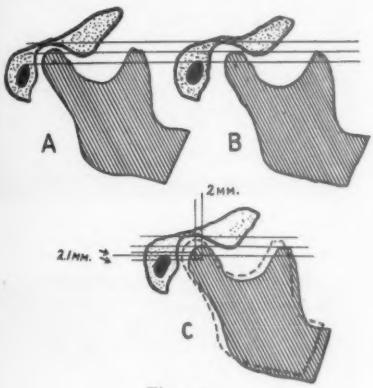

Fig. 11.

head involving all the basic principles with points and cranial planes, allowing accurate registration of each position and duplication of that position, will soon be presented to the profession.

Roentgenograms of the joint made by the above-described technic, with its high degree of accuracy, lend themselves to exact measurements which can be used in correcting joint deformities and positioning the mandible to its normal relation.

MEASUREMENT FOR RECONSTRUCTION

In Figure 11, A represents an abnormal position of the condyle head to the fossa. A normal position has been defined in a previous paragraph. We first make a tracing from the roentgenogram of the joint in a closed position holding the teeth in existing centric occlusion. Letting A represent this tracing, we place the condyle head in a normal, or corrected, position with splints, shown in B. The distance the condyle head is brought down is shown in C. The distance according to measurement is down, or "open," 2.1 mm. and forward 2 mm. These measurements can be accurately used in reconstruction in the majority of cases.

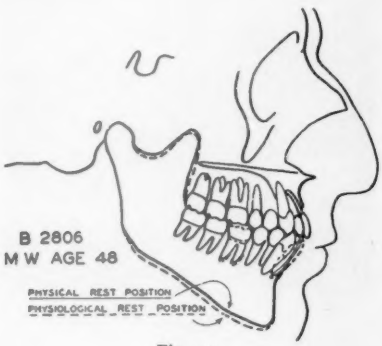

Fig. 12.

REGISTRATION OF NORMAL VERTICAL DIMENSION

In describing normal vertical dimension, we may use and accept the Planer Scheme given the profession many years ago. Every human being has two rest positions of the mandible. The first is known as the physiologic rest position. The second as the physical rest position. The physiologic rest position is that position assumed by the lower jaw when the patient opens the mouth and then brings the lips together in rest position. All muscles and ligaments will then be in a relaxed condition. In this position, there is a separation between the upper and the

lower teeth when the lower jaw then hangs on its relaxed muscles with just the lips touching. The position is called the physiologic rest position. This position is maintained throughout life and does not change with age or loss of teeth.

The physical rest position is that position assumed by the lower jaw when the teeth are brought together as in centric occlusion. This position is lost when the last opposing teeth are gone. After many tests to determine the normal distance between physiologic and physical rest position were made with a cephalometer and rechecked in the mouth by the patient, a normal of 1.5 mm. between the two rest position was recorded. This represents persons having normal occlusion, with normal condyle relation and no loss or wear of teeth.

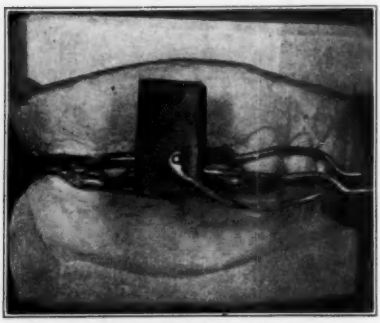

Fig. 13.

Figure 12 shows a tracing from superimposed roentgenograms. This record proved of great value for all reconstruction work because from it can be determined the answers to important questions as to whether it is a closed bite condition, and, if so, how far the bite should be opened by actual measurement.

TECHNIC OF REGISTRATION

For practical application in all reconstruction work where natural teeth are present, accurate models are made on which cast or band material is adapted, around the molar and bicuspid teeth on each side, both upper and lower, allowing the teeth to close in centric occlusion with no interference. To this group of bands or castings, two small round wires are attached and so adapted as to exit at the corner of the mouth without interference and bent back toward the posterior exterior surface of the face so as to register at the first molar region.

If a record is made in the cuspid or bicuspid area, it will show an error, because a 1 mm. opening in the molar region is multiplied by 3 in the anterior region.

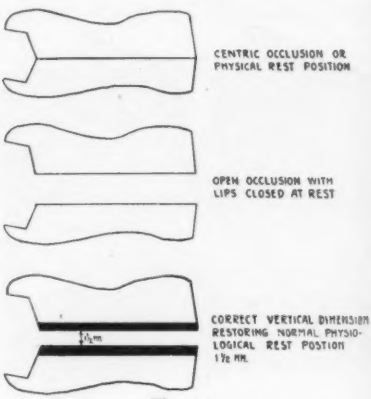
CENTRIC OCCLUSION OR PHYSICAL REST POSITION
OPEN OCCLUSION WITH LIPS CLOSED AT REST
CORRECT VERTICAL DIMENSION RESTORING NORMAL PHYSIOLOGICAL REST POSTION 1½ MM.

Fig. 14.

In recording the two rest positions, care must be exercised to have the patient sit absolutely erect in the chair and not in a ventral or dorsal position, because the patient will, in one position, strain the lower jaw forward and, in the other, retrude the jaw. Both positions will introduce errors in recording.

Figure 13 shows the pin and recording plate in place with the plate over the first molar area. These appliances are now fitted in the mouth and cemented to place so as to assure the greatest accuracy.

The patient is now instructed to make a wide opening and then bring the lips together in a light touch. At this point, a

mark is made horizontally on the plate recording the physiologic rest position. The patient is then instructed to close the teeth in centric occlusion. A second horizontal mark is made on the plate at this point. This line is recorded as the physical rest position. (Fig. 14.)

Since the normal distance between physiologic and physical rest positions was established as 1.5 mm., and assuming that the record made by the patient showed a distance between physiologic and physical rest positions of 4 mm., we subtract 1.5 (allowing for normal) from 4 mm., which gives us 2.5 mm. that this bite has closed. If, on the other hand, the physiologic and physical rest positions are equal or come to the same point on the recording plate, the bite has been opened too far and destruction is sure to result. We must allow 1.5 mm. for normal between the two rest positions in order to allow sufficient freedom for speech and greatest comfort for mastication and produce no trauma.

When the teeth have been worn nearly to the gum line, and there is a great amount of deformity on the other side caused by allowing the lower teeth to be absent without replacement over a long period of time, it is suggested that, before registration of both rest positions is attempted, the two molar teeth and part of the alveolar process be surgically removed, as they are greatly elongated owing to the fact that there has been a lack of function and opposition. Although these cases are rare, the above-mentioned treatment is recommended before registration of vertical dimension and the beginning of the attempted reconstruction.

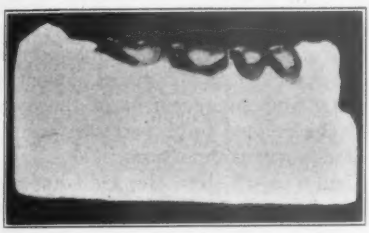

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

Another interesting principle should be mentioned at this point: The distance recorded from the tracings of the roentgenograms of the joint where the condyle is brought down and forward so many millimeters to place it in a normal position in the fossa tallies in nearly all cases with the distance the bite should be opened, as recorded by the mouth registration obtained for correct vertical dimension.

The records now made by both tracings and roentgenograms and those re-

corded from rest positions of the patient are transferred to an articulator. It should, however, be borne in mind that the articulator must register the distance for opening and advancing the mandible and also allow for correction of a lateral shift if necessary, because there may be rotation plus a lateral shift, which would throw the median line off center. Bite-blocks are now made and placed on the teeth and the patient is again roentgenographed for study of the new position. If the new position is not correct, a corrective measure can be applied and checked roentgenographically. After this has been verified, we may proceed to make splints, as shown in Figure 15, on the posterior teeth, either upper or lower or both. The splint material should be of hard, dense material. The splints are reground in the mouth for high points of occlusion and then cemented to place for trying-out. After we have accomplished our corrective measure with the splints, we may proceed to the reconstruction work.

In certain technics advocated at the present time, mere opening of the mandible is recommended and the new centric relationship is registered in this new position. It has been the experience of many in the past that mere opening does not correct and bring back the head of the condyle to its normal relation; that, in most cases, advancement of the mandible in addition to opening (normal) or increasing the vertical dimension is desirable and more satisfactory as a corrective measure for all reconstruction technic. For this additional advancement plus opening, roentgenography is invaluable as a means of checking for accuracy and making comparisons with previous roentgenograms.

After the patient becomes comfortable in wearing the splints, and all corrective measures have been checked over, the operator may proceed with the permanent construction. He should use the splints in securing the new centric occlusion and build four piers on each side, opposing each other, and thereby obtain permanent guides for completion of the work.

Any articulator may be employed that will register and maintain the amount of opening and advancement of the mandible determined to be necessary for the desired corrective measures.

Figures 16-18 show the right and left sides of a corrected case. The head of the condyle having been positioned to its normal relationship in the fossa, the entire mouth was restored to normal relationship and function.

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Medical Arts Building.

RECOGNITION, INTERPRETATION AND MANAGEMENT OF PERIAPICAL BONE LESIONS IN DENTAL HEALTH SERVICE

By Ralph F. Sommer, D.D.S., M.S., Ann Arbor, Mich.

WE, the members of the dental profession, educated in the basic biologic and medical sciences, are qualified to render a valuable health service through the maintenance of the normal health and function of the masticatory portion of the digestive system.

In the fulfilment of this responsibility, dental curriculums not only train us in many of the essential sciences, but also tend to develop our mechanical ability to the extent that we may satisfactorily restore lost structures by artificial means. In their zeal for the achievement of mechanical perfection and the development of technical skill, many dentists become oblivious to what constitutes an adequate dental health service. Let us briefly analyze the various periods through which the majority of our patients pass and see what their dental needs really are.

Period of Early Childhood (from 1 to 6 years)

Dental caries often makes its appearance during the period of early childhood, and, unless properly checked, will cause considerable destruction of the deciduous teeth, with subsequent infection of the permanent set through proximal contact. Extraction of the most hopeless members affords the simplest and most common means of rendering the first dental health service for these young patients who might otherwise suffer from pain, loss of masticatory function and subsequent digestive disturbances. The generous endowments created by philanthropic enterprises, such as the Couzens' Fund of Michigan, represent a milestone in the provision of more extensive dental health service among underprivileged children.

Period of Early Youth (from 6 to 20 years)

The transition from the deciduous to the permanent dentition occurs at a time of great susceptibility to dental caries, when the patient is unaware that there may be serious sequelae if this disease remains unchecked. Owing to the large size of the pulp chambers of the developing teeth, pulp involvement under caries or through the irritation of fillings becomes a problem of major importance. Fracture of anterior teeth from injuries at play also causes a high percentage of pulp involvements. Personal pride among most young people of this school age makes them particularly conscious of the disfigurement of the anterior teeth and, in the majority of instances they wish to have the normal appearance and function restored. The loss of teeth during this period is, in most instances, permanent because replacements of a fixed nature are practically contraindicated and any removable appliance is apt to be worn outside the mouth. The conservation of pulp-involved teeth during this period, on the other hand, gives the greatest promise of success and opens the field for esthetic

(Read before the Greater New York Dental Meeting, New York City, December 7, 1938.)

restorations which far surpass replacement by any removable appliance that might be substituted.

PERIOD OF EARLY ADULT LIFE (FROM 20 TO 30 YEARS)

The period of early adult life is perhaps the most "tooth-conscious" period of all. The young adult has either completed his secondary school education and has become self-supporting, or he continues with higher education and associates with fellow students accustomed to adequate dental care. Although at this age dental caries as a rule is less active, teeth that have been filled in early youth with plastic fillings which lie in close contact with large pulps frequently present extensive areas of periapical disease and are in need of some form of root-canal therapy. At this age, the prognosis of replacement of hopeless teeth by fixed bridgework is far more favorable than it would have been during the second period. Frequently, bridge abutment teeth of strategic importance require root-canal operations, which, if not successfully managed, seriously complicate the problem of retention in more extensive restorations.

PERIOD OF MIDDLE LIFE (FROM 30 TO 50 YEARS)

During middle life, practically every phase of operative dentistry may be indicated. Patients in this group usually present several pulpless teeth in various stages of disease. Operative dentistry may have reached the limit of its service and decisions must be made as to the possible retention of a part or all of the remaining teeth, or their extraction and subsequent replacement with partial or complete dentures. In the restoration of missing teeth by means of partial dentures, the retention of pulp-involved teeth that are of strategic importance often adds considerably to the success of the denture; whereas the loss of some particular abutment might immediately make the use of a partial denture either impossible or else functionally unsuccessful. Patients of this age group quite frequently present themselves for dental service on the advice of an attending physician who is in search of a possible causative factor in some physical ailment under treatment at the time. These patients have been and still are the subject of endless debate relative to the effect which questionable teeth may have on the general health. We have too frequently perpetrated injustice on our patients, primarily owing to our belief that the removal of teeth was beneficial. With the training he has received, the dentist should be able to make his own diagnosis, not relying helplessly on physicians, who are too often totally unqualified to pass judgment on dental conditions.

From the economic standpoint, the extraction of a tooth, in the great majority of instances, represents a decided loss to the patient and increased difficulty for the dentist. Unfortunately, one cannot make a restoration of a tooth after it has been removed. Statistics have shown that of the great majority of extracted teeth, comparatively few have been restored by means of bridgework. Examination of thousands of full-mouth roentgenograms annually for the past fifteen years of patients from all walks in life and from practically every state in the union has convinced me that the dental need of the people of this country is beyond comprehension. The chief reason for the loss of so many thousands of teeth lies in the inherent dislike and fear which the average dentist has for root-canal operations. In New York State, however, we may proudly say that, during the past few years, there has been a decided change in attitude toward the pulpless tooth on the part of both the medical and the dental profession. This has been evidenced by the fact that, during the past five years, we have built up a postgraduate root-surgery clinic in the university that has continuously had a capacity enrollment. Practicing dentists are coming from considerable distances to spend one or two

days a week in this clinic. Their enthusiasm in this field of operative dentistry has brought them back for periods of one, two, and in some cases, four years. Just what has taken place that should make dentists who have been in practice for ten or twenty years drive perhaps 75 or 100 miles to spend a day a week away from their offices in intensive training in root surgery? The answer is quite simple: They have come to realize that when a tooth has been removed, it ceases to be a potential candidate for any form of operative dentistry. The patient soon becomes reconciled functionally to the space left by the missing member and automatically adjusts his masticating function as best he can. Unless a bridge has been arranged for before the extraction, in all probability it will never be made.

Second, dentists have shirked root surgery because their training in this field has been far too inadequate and because they lack confidence as to the end-result. The attempts made in most cases have been failures from the start, and have been the direct cause of the attitude which some of our medical confrères have on this subject. Third, dentists have not impressed their patients with the scientific accuracy of the operation or met the rather exacting technical requirements, based on our knowledge of bacteriology, pathology and radiology. The patient is quick to realize that the mere changing of cotton in a tooth does not constitute a service for which a high degree of skill is necessary and for which any appreciable fee should be charged.

Let us briefly point out the professional training essential in the administration of present-day dental health service through the medium of root-canal surgery.

ROENTGENOLOGY

Although roentgenograms have been used as diagnostic agents for nearly forty years, the development of roentgenographic equipment has progressed far more rapidly than has the ability of dentists to interpret the findings. The greatest difficulty lies primarily in a lack of understanding of normal roentgenographic anatomy, and the variations in normal bony structure, and in the assumption that every dark space is indicative of infection.

Far too often, the roentgenographic equipment is used to impress the patient rather than as an aid in finding conditions not visible clinically. Almost without exception, dentists who bring or mail in roentgenograms for interpretation invariably accompany their request with profuse apologies for the poor quality of the film sent.

Bone resorption, which appears dark roentgenographically, and which is so generally found in the periapical regions of teeth, may have causal factors other than bacteria. Mechanical trauma, or the use of drugs, or aseptic autolytic agents, which are irritating products of protein disintegration, may produce notable bony changes analogous in appearance to those brought on by infection. Positive diagnosis can be made only from actual bacteriologic tests or direct smears from the region in question and not from roentgenographic shadows.

Periapical bone involvement is generally found to be far more extensive at the time of resection than the roentgenogram would seem to indicate. For this reason, in preparation for a root resection, it frequently becomes necessary to devitalize one or two healthy adjacent teeth whose apices closely approximate the involved area. Unless this precaution is taken, the entire case may prove to be a failure, owing to interference in the blood supply of the vital teeth at the time of curettement. In making postoperative roentgenographic checkups of teeth previously treated or resected, care should be exercised to duplicate as accurately as possible the degree of angulation and the exposure time, in order to eliminate distortions which might be misleading in making a prognosis of the case.

THERAPEUTICS

The use of drugs in the treatment of periapical disease has, for many years, been too much in the nature of quackery. If one drug did well in one instance, it was expected to perform miracles in all cases. Treatment of periapical disease should not begin until the causative factor has been established. Almost without exception, this can be done by culturing the area in question and interpreting the findings. From that moment, sterilization of the periapical region may be brought about either through drug therapy or the surgical removal of diseased periapical tissues. One might state that root surgery is dependent on the fulfilment of three essentials:

1. It is necessary to reach the seat of the disease.

2. It is necessary to eliminate completely the cause of the pathologic condition. Cultural tests will indicate when this has been accomplished if the condition is of bacterial origin.

3. It is necessary to seal hermetically the entire canal in order to prevent the recurrence of infection. A tooth thus filled may be regarded as one in which the canal does not exist. Therefore, if nothing can enter the canal from without, nothing of an irritating nature can return to the tissues from within the canal. As has been so often stated by histopathologists, we are justified in assuming that the cementum covering the root is an impervious barrier against the substances that might otherwise pass in either direction. Teeth that have been rendered sterile and hermetically sealed are apt to remain so indefinitely, and will have no deleterious effects on the patient's health. Unfortunately, pulpless teeth are so seldom properly treated that dentists and physicians alike believe that once the pulp has been removed, the tooth immediately becomes a permanent menace, remaining so for as long as it is in the mouth. This is a situation for which the dentists are entirely to blame. Under certain conditions, Nature itself gradually obliterates the pulp chambers through a process of calcification, and we frequently see teeth in which there is no evidence of a root canal, and vitality tests are negative, yet the periapical regions are absolutely normal.

The choice of drugs should conform to the requirements for dealing with the particular disease under treatment, and all element of guesswork should be eliminated. We have yet to find the ideal remedy for combating all types of organisms. The course of treatment depends on the diagnosis. The roentgenographic findings, together with progressive bacteriologic tests, will indicate the type of drug to be used. To be more explicit: One may expect to find that a definitely walled-off granuloma will give negative cultural reactions, or attenuated organisms may be present which can be destroyed by one treatment with a halogen drug. On the other hand, the proliferative types of osteitis may harbor highly resistant strains which can tolerate certain drugs and can be destroyed only through a successive change of drugs. Just when sterilization is complete can be determined only through cultural tests. It is interesting to note that our postgraduate students who previously had relied solely on the nose as the determinant of sterilization find their entire attitude changed toward root surgery once they become familiar with the bacterial histories of cases.

From an economic standpoint, the surgical removal of periapical bone lesions in all anterior teeth, including bicuspids, affords a most effective means of rendering a dental health service. Among the hundreds of resections in our clinic, the degree of success is about 95 per cent. When we consider the extensive bone involvements that are included in this estimate, this percentage is unusually high. Roentgenographic checkups taken at constant angulation and exposure time during thirty-day intervals while bone regeneration progresses furnish accurate informa-

tion on the effectiveness of this form of surgery. The average time required for complete bone regeneration in areas of ordinary size is about ten months. It is possible that this regeneration period can be greatly reduced by the use of bone-powder implants, but, up to the present, this procedure is still in the experimental stage.

In our experience among university students who fall between the second and third age periods previously mentioned, we have found a high percentage of periapical bone involvement, particularly in anterior teeth which carry extensive synthetic fillings or jacket crowns closely approximating the pulp. In many of these cases which are referred to us from the university health service, dental focal infection is suspected. In many of these, dental disease is not responsible for the general physical condition, but there are others in which there is an apparent relationship which cannot be attributed to coincidence.

BACTERIOLOGY

This subject has been included in dental curriculums for a great many years and no more practical application of it can be found in dentistry than in the rational management of periapical infections. Since it is impossible to determine from a dental roentgenogram whether a tooth is infected, a bacteriologic test of the region involved serves as the only means of knowing when treatment has been completed. Most dental clinics today require negative bacteriologic tests in all root canals prior to filling. Convenient laboratory facilities for students make this procedure possible. However, the question invariably asked by dentists is "How can I do this in my office?"

The equipment necessary to carry on this type of service consists of a small incubator capable of maintaining a constant temperature of 37.25° C., culture media, sterile instruments and sterile paper points. Culture media can be obtained from any hospital, board of health or bacteriologic laboratory. One laboratory supplies tubes of beef heart infusion broth in packages of one dozen each or in the form of prepared dried powder. If a standard incubator is not available, a convenient and inexpensive substitute can be provided by using an ordinary thermos jug containing warm water at 37.25°C.

Briefly, bacteriologic tests are invaluable as a practice builder because:

1. The dental roentgenogram indicates a departure from normal, but does not reveal the true state of disease or the presence or absence of infection.

2. It is difficult for the average patient to evaluate in his own mind the actual pathologic condition which the roentgenogram seems to indicate.

3. The bacteriologic culture is the only means by which the operator can determine whether living organisms are present in the area under treatment, and it affords a definite proof that the treatment has been effective and the tooth is safe for retention.

4. Culture tests are the only means the dentist has of informing a referring physician of the presence of infected teeth in patients with physical disability or of the safety of such teeth after successful treatment. Roentgenographic signs are only one means of determining health and disease, but they do not reveal the actual existing conditions.

Our technic in brief is as follows:

1. Isolate the tooth in question with the rubber-dam.

2. Sterilize the entire field of operation by swabbing with tincture of iodine, followed by an alcohol wash.

3. Enter the pulp chamber with a sterile bur. We prefer to use metaphen germicidal solution for sterilizing all hand instruments. These are kept in sterile towels during the operation.

4. Absorb the moisture from the apical region of the canal on a sterile paper point.

5. Drop the paper point into a culture tube. Be sure to flame the mouth of the tube before and after dropping in the point.

6. Incubate at 37.5° C. for forty-eight hours.

7. Examine tubes at forty-eight-hour intervals, during which the treatment has been active.

CONCLUSION

Let me emphasize again that the recognition, interpretation and elimination of periapical bone infection, much of which may lie in dangerous approximation to the nose and maxillary sinus, constitute a dental health service worthy of merit. By rendering this type of service acceptably, we justify our medical and biologic training. The intimate relationship which teeth have to general physical well-being serves only to link us more closely to a health service of concern to physician and dentist alike. Let us hope that our associations with our medical colleagues will contribute to the best interests of our patients.

Michigan Theater Building.

ASSOCIATED MAXILLARY SINUS AND DENTAL DISEASES

By John Egbert Nyman, D.D.S., Chicago, Ill.

ASSOCIATED pathologic conditions of the maxillary sinus (or antrum, as it is commonly called) and the teeth and surrounding structures, although relatively infrequent, nevertheless are so serious when they do occur that they merit earnest consideration.

This situation becomes most serious if, as sometimes occurs, the maxillary sinusitis extends and involves the upper sinuses of the sphenoid and ethmoid, and a pansinusitis is established. Therefore, persistent antral disease should not be subjected to long continued palliative treatment, as it is apt to progress to a chronic pathologic condition, with the formation of polypi and granulomas, which, in time, is likely to involve the bone.

For the protection of the oral surgeon, as well as for the benefit of patients, a cooperative relationship with a good rhinologist should be formed when one engages in oral surgery. Looking back over a long career, I note that I have been called most frequently as a witness in damage suits in cases wherein it was claimed that antral pathologic conditions were due to the neglect or faulty operations of the dentist, exodontist or oral surgeon.

A primary antral infection may subsequently involve the apical area of a root or roots which invade the floor of the antrum and are covered merely by the floor membrane and by the pericementum of the tooth or teeth. In such cases, infection and death of the pulp may occur rather quickly and a constant residual source of infection for the sinus be established, with frequent acute recurrences.

If such invasion does not exist, but the apices of the teeth are in close proximity

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(Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

to the floor of the antrum, with but a thin bone section intervening, the spread of the infection to involve the pulps at the apical region will, of course, be slower. However, the cases of primary sinusitis involving secondarily the pulps of the teeth are rare, and it is difficult to determine whether this is the order of infectious extension, unless the crowns of the teeth have no cavities, fillings or inlays, and the teeth have never suffered a traumatic shock.

Associated antral and dental disease is usually of dental origin, being due to an extension of peridental or apical infection to the sinus. Experienced observers have placed the percentage of antral disease arising from dental infections at from 20 to 50. The cases that I have observed have most frequently been due to peridental infections, the result of retaining teeth extensively involved with pyorrhea in the mouth by splints, particularly in the cases of multirooted bicuspid and molar teeth in which the pericemental infection has extended above the bifurcations of the roots.

Consequently, I most emphatically advise against anchoring loose teeth affected with pyorrhea, either by ligatures or by splints. One of the worst cases that I was ever called on to treat, a case resulting in necrotic destruction of the entire floor of the antrum, was due to this unwise procedure. In this operation, under regional procaine anesthesia, the entire floor of the antrum was removed until edges of sound bone were obtained. Then a flap with its periosteal membrane was brought over from the palatal region and sutured in position, and an anterior side wall was established through an intranasal operation. The case fortunately presented no postoperative complications, and thirteen years after operation, there is complete regeneration of the bony floor.

The antrum is often infected from putrescent root canals if the apex of the tooth is close to the antral floor, and operators have evidently sometimes carried infection into the antrum by penetrating a thin floor with broaches or pulp-canal files, and occasionally a roentgenogram discloses a broken broach in the antrum. It is also sometimes infected when a root tip is forced into the antrum in an apicoectomy performed by the splitting off of the tip with a chisel. But probably antrums are most often infected by the inadvertent forcing of a partly or fully impacted upper third molar or embedded roots of this or other upper molars and bicuspids into the antrum, or by tearing away a section of the floor of the antrum in extracting *in situ* upper molars with roots that diverge above the gingivae and then converge, enclosing a section of the maxilla, or undergo exostosis at the apices.

To avoid these occurrences, I suggest that:

1. Roots be amputated with a fissure bur so that the tip can be brought down and out through the opening in the buccal plate of the maxilla.

2. Embedded or deeply fractured roots be removed by first cutting a trench with a bur buccally for a buccal root and palatally for a palatal root, then loosening the root by pressure toward the trench.

3. Partly or wholly impacted upper third molars be removed by first removing a section of bone posteriorly to the crown and then turning the tooth back, out and down with an exolever instead of attempting to force the beaks of forceps in between the bone plate to seize the crown of the tooth.

4. To avoid tearing out a section of the floor of the antrum, the roots of molars that diverge near the gingivae and then converge near the apex be separated either by bur or chisel and removed singly.

5. Burs may be used, which can be safely done in any bone operation, if they are sterile and sharp and are run at low speed and with but little pressure. Many

times, more definite separations and cleavages can be obtained by their use, and with less danger of splintering the bone than by the use of chisels alone. I have never had what could be called operative trauma from the proper type of burs properly used, and they are an excellent adjunct to the chisel in removing large sections of bone quickly and definitely. A number of holes are drilled along the line of removal, and with a few taps of the mallet on the chisel, the section comes out in one piece.

6. A curet be used carefully and gently in the apical regions of the sockets. The granulomas should be removed with gentle instrumentation, but no bone structure be scraped away.

7. No free packs be placed in sockets having a large opening in the antrum, as they frequently slip into the sinus and are not easily found or removed except by radical operation.

8. Since fractures of the maxilla involving the antrum frequently result in a chronic sinusitis, it is usually wise to have a rhinologist make an anterior nasal window for gentle irrigation with physiologic salt solution as soon as the fracture situation permits.

9. If malignant or cystic developments are suspected in the antrum, immediate consultation be had with rhinologist, general surgeon and internist. The oral surgeon should not operate unless he has had special training and experience in rhinologic surgery, as well as oral surgery, and particularly in the surgery of malignant and cystic conditions.

10. The oral surgeon, unless he is also a qualified rhinologic surgeon, is only justified in operating in maxillary sinusitis if the pathologic condition is of dental or oral origin and presents dental and oral complications.

In some damage suits, the oral surgeon's position has been jeopardized because it was proved that he performed a part of the operation in the nasal cavity.

But suppose the unfortunate thing has happened: a section of the floor of the antrum has been torn away in extracting a molar. The best procedure is to simply swab out the socket with 20 per cent argyrol, some of which may escape into the antrum, and then gently wash out the antrum with a small quantity of sterile physiologic salt solution. A closely folded pad of tape gauze impregnated with either mercurochrome or acriflavine is placed over the socket extending over the edges of the socket opening and held in place with a figure-of-eight ligature passing around the adjacent teeth. Under no circumstances should a pack be placed in the socket, as a chronic fistula will probably result and these fistulas are not easily closed; whereas if a pad is placed over only the socket to keep saliva, mucus and food from being forced into the antrum, the opening into the antrum will be filled with repair tissue and the bone will be regenerated.

Suppose, again, that a third molar or a root of a molar or bicuspid, more or less infected, was forced into the antrum and has lain there until a chronic infection has developed involving the antrum membrane with formation of pyogenic polypi and granulomas, but has never become acute because there was a comparatively large natural opening into the nasal cavity through the *ostium maxillare*, but finally the chronic condition became worse and roentgenographic examination disclosed the actual situation, a radical operation being imperative. Though complete roentgenographic studies are made of the case, they often fail to give a definite anatomic picture of the sinus.

The researches of W. F. Mustian[1] and L. M. Ennis and Oscar Batson[2] disclose that in 25 per cent of 100 antrums sectioned, the antrum extended from the tuberosity to a point between the second bicuspid and the first molar; whereas, in approximately 75 per cent, it extended to a point between the cuspid and the first bicuspid teeth. In two cases, it extended to between the lateral and the

cuspid teeth. Sometimes, the floor of the antrum lies much above that of the nose, sometimes much below it. In a few cases, the floor of the antrum extended under the floor of the nose nearly to the median line. Usually, the level of the antrum floor is slightly below that of the nasal floor; or the floor of the antrum may dip down between the roots of the bicuspid and the molar teeth.

Occasionally, a complete septum was found forming two antrums. Sometimes, partial septa arising from the floor formed two or three basement fossae. Considering all these variations, it is advisable to begin the buccal opening at a point well above the apices of the roots between the second bicuspid and the first molar and proceeding directly back in an anteroposterior direction until the antrum is reached. This opens any maxillary sinus successfully, no matter how abnormal as to size, shape and situation. Occasionally, operators attempting to open into the antrum at a point anterior to this and deflecting their instruments toward the median line have finally opened into the nasal cavity, missing the antrum entirely.

The radical operation is the modified Caldwell-Luc performed preferably under block anesthesia. The patient is examined as to blood pressure, coagulation time, possible leukopenia, anemia, albuminuria, diabetes and syphilis. Complete anesthesia, without the inconvenience of inhalers or intratracheal tubes, or the sometimes distressing complications and sequelae of general anesthesia, can be secured by giving the patient a 1.5 grain capsule of nembutal or 3 grains of amytal the night before operation and repeating the dose a half-hour before operation. The patient then comes to the operation in a sleepy condition that is almost a narcosis and is not disturbed by the sounds of the operation, and the sinus can be so anesthetized by injections and intranasal applications as to make the operation painless.

In addition to the maxillary tuberosity, the infra-orbital and the anterior and posterior palatal injections, after an intranasal surface application by swab of 10 per cent cocaine solution, an extra-oral injection is made at the ala of the nose carrying the needle in at the angle made by the floor and the side wall of the nose. This last injection, added to the others mentioned, has, according to my knowledge, produced complete anesthesia in every antral operation in which it has been used.

The technic of the operation has been published many times. The teeth and the soft tissues on the side to be operated on are dried and sponged with 2 per cent compound solution of iodine (Lugol's). This is an aqueous instead of an alcohol solution of iodine, more diffuse in its action, as effective as an antiseptic and less irritating to the surface of the soft tissues. If it is thought that a window must be made in the nasal wall of the antrum, the same sterilizing measures are taken and a postnasal plug of gauze with a safety string of strong silk suture is attached and placed in position to prevent blood flowing into the pharynx. The free end of this safety ligature is fastened to the outside of the opposite cheek with adhesive tape. An incision is made from a point 1 mm. above the apex of the distal root of the second molar down for 1 cm. toward the gingivae; then forward to a point opposite the lateral incisor, and then up nearly to the infra-orbital foramen. The gum flap with the periosteum is lifted and an opening is made in the buccal wall of the antrum above the roots of the teeth and above the line of the gum incision, so that when the mucous flap is sutured into position, part of the periosteum of the flap will be in contact with bone tissue. This initial opening should be made at a point above and between the apices of the roots of the first molar and the second bicuspid. A buccal opening is enlarged with suitable bone forceps to about 1.5 cm. in width by 3.5 cm. anteroposteriorly, so that a small elec-

tric bulb can be inserted in the opening to determine the condition of the entire antral membrane and the position of foreign objects, if any are present. I use a small bulb lamp in a long tube attached to a handle containing two dry cells, which provides for complete illumination of the antrum with a cold light, and one can determine whether there are polypi, and their location; whether there are bone septa arising from the floor, dividing it into a number of basement fossae, and whether there may be a complete septum dividing what would normally be one antrum into two antrums. If the operation is performed soon after the antrum has been invaded and before a chronic pyogenic condition, developing infected polypi on the nasal wall of the antrum, has been established, and the natural ostium is of normal size, an anterior nasal window is seldom necessary.

The antrum is gently washed out with about 15 cc. of physiologic salt solution, then loosely packed with tape gauze saturated with hexylresorcinol solution 1 : 1000. This packing is allowed to remain for three minutes, then removed, and the cavity is again washed out as previously with the salt solution. At this point in the operation, I prefer not to use antiseptic solutions which stain the antral membrane as these stains tend to confuse the macroscopic examination.

The foreign object is removed and patches of polypi are wiped off with pledgets of coarse gauze. The patches of polypi, if situated so that it is difficult to remove them with a coarse gauze pledget, may be removed with a large dental bur set in a cone-socket handle and gently rotated by hand. The mucous flap is now sutured in place and the line of the incision is swabbed with ferropyrine powder to seal this line with a firm coagulum.

If the operator believes that subsequent irrigation may be necessary, an opening can be provided for that by threading 32-gage silver wire through a silver button about 1 cm. in diameter, twisting the free wire into a rope and inserting this through the flap after suturing. The button will be held in place by the pressure of the lips, preventing mucus, saliva and particles of food from the oral cavity from entering the antrum, and keeping the twisted wire from slipping into the antral cavity. This wire can be removed and replaced when the operator wishes to irrigate. When irrigation is no longer needed, the wire is removed, the edges of the small opening are rasped slightly and a coagulum seal is obtained by applying ferropyrine.

If the case is one of chronic infection and the nasal side wall membrane is found to be definitely involved, an anterior window into the nasal cavity should be made. With the antral cavity illuminated by head-mirror and head-lamp, the small electric bulb is then placed in the nasal cavity. The transmitted light will show the location of the nasal floor and also the position of the inferior turbinate bone attachment. Then, after removal of this degenerated membrane, part of the nasal side wall bone is removed with a spear-pointed spoon excavator, or an opening is made with a trocar, care being taken if possible not to tear away the periosteal membrane from the nasal membrane in doing so.

An opening of sufficient size to admit a small periosteotome is made; with the periosteotome, the nasal membrane is separated from the bone, and, with suitable bone forceps, an opening is made of about 1 cm. anteroposteriorly and 1.5 cm. in vertical dimension down to the floor of the nose. Then an incision is made in the nasal membrane from the lower part of this side wall opening to the upper part along the anterior border. A similar incision is made along the posterior border of this opening and finally a postero-anterior incision along the upper border of this opening.

The nasal flap is now turned down onto

the floor of the antrum, the surface of the floor membrane that will be covered with the flap having been scarified, and a plug of sterile gauze well saturated with a paste consisting of subiodide of bismuth powder with enough sterile lanolin added to make a stiff paste is inserted. The free end of this folded tape gauze is brought down to the meatus of the nose. This may be allowed to remain in place for a period of from four days to a week. On gently removing this pack at that time, it will usually be found that the nasal flap has formed an attachment to the floor of the antrum. The buccal flap covering the opening in the buccal wall of the antrum is now brought down into place and sutured as before, without the insertion of anything in the nature of a drain to maintain an opening, as was suggested in cases in which no nasal window was provided. If the nasal window is made by simply rasping out the nasal wall, usually this opening closes in time, and, in cases of chronic infection, a permanent nasal window is beneficial, permitting additional aeration and offering a means of easy irrigation if necessary, or in case another antral infection occurs.

I do not advise the use of powerful antiseptics. I have not found them necessary and they have a disturbing effect on both hard and soft tissues. I have found that after removing the definitely infected and degenerate tissues, physiologic salt solution, 1 per cent Lugol's solution, a filtered mild solution of sodium perborate and a 5 per cent freshly prepared argyrol solution are adequately antiseptic for irrigation. After irrigation, any sense of irritation can be allayed by gentle irrigation with physiologic salt solution to which 1 per cent of a mixture of phenol and glycerin, equal parts, has been added.

I also advise against vigorous curetting of the bone or disturbing any more of the mucous membrane except to remove that which is obviously degenerated. The less the scar tissue in the antrum, the better the postoperative results. If, in examination of the antral cavity with illumination, it is found that there are discharges from the sphenoid or ethmoid sinuses into the maxillary sinus, or if, after the operation without a nasal window, it subsequently develops that an anteronasal window is advisable, the case should be placed in the hands of a rhinologist, who is, of course, more familiar with intranasal operations.

Reference has been made here to testifying in damage suits in cases of antral infection arising from dental operations. Every oral surgeon should carry a maximum insurance policy in a dependable company, one which specifically protects him against suits for return of fees. He should acquaint himself through his insurance company of special court rules and decisions and know what evidence can be introduced in favor of the doctor. Some state laws and court rulings are strangely illogical and prejudicial to the practitioner as to limitations concerning evidence that can be offered in regard to the patient and the case, particularly as to evidence from some other doctor who has examined the patient either before or subsequently to the operation.

Careful records of each case, made immediately after operation, should be kept. If an accident does occur, and it may occur to the most careful operator, the patient should at once be told in the presence of the assistant what has occurred and be advised as to what should be done to correct it. If the dentist is competent to make this correction, he should proceed at once; if not, the case should be referred immediately to some one who is.

Afterwards, he should draw up a concise complete statement as to what has occurred and the fact that the patient was so informed. This should be signed by the dentist and his assistant or assistants, and then be acknowledged before a notary. Should a damage suit come to trial and these assistants be not available as wit-

nesses, this sworn statement may often be introduced to corroborate the testimony. The fact that the dentist immediately and definitely informed the patient as to what occurred and what should be done will have a most favorable influence on the judge and the jury; whereas failure to so inform the patient places the dentist in a very bad light.

There should be an agreement among a number of reputable, well-known experienced practitioners in every community that they will be ready to testify at any time as to the professional standing and ability of any one of their number who may become involved in a damage suit. This is an important factor in every case.

While on the stand as a witness, the oral surgeon should be careful in replying to long hypothetical questions from a plaintiff's attorney. They are adroitly composed, demanding a categorical reply of "yes" or "no," with the intention of securing a reply which will form the basis of an argument to the jury that the witness is incompetent or culpable. These questions are tricky and full of concealed pitfalls. The witness can always first reply that the question is so involved and apparently contradictory in sections that he must ask the attorney to repeat it. This request calls the jury's attention to the fact that it is a tricky question designed to put one in a false position. When the question is repeated, the witness may safely state that he cannot give a categorical reply but that he will be glad to give a qualified answer. His manner on the stand should be calm and confident and should suggest frankness. Any indication of resentment toward the plaintiff or his attorney or witnesses should be avoided.

Many a damage suit that otherwise might not have occurred has been brought on by casual, thoughtless, uncalled-for criticism on the part of a doctor subsequently visited by the patient. The patient with a grievance usually misstates or half-states a case, relating only that which seems to justify his resentment.

Derogatory criticism of a fellow practitioner does the patient no good, nor does it help his condition, and though the witness may not realize it, it lessens the patient's confidence in and regard for him, and may precipitate a lawsuit obliging the witness to leave his practice to testify as to his impulsive criticism and waste many hours in court waiting to be called as a witness for the plaintiff. Finally, one does any practitioner a serious injustice by criticism of him without hearing his side of the case as well as the patient's. Otherwise, it must be obvious that one cannot know all the circumstances of the case which should be known before expressing any opinion as to what was done.

The operator should be careful in his diagnosis, operate according to accepted technic, avoid deception and keep complete records, and he will escape many embarrassments and perhaps loss of prestige, as well as financial loss.

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A FURTHER STUDY OF INLAY PROBLEMS

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At the meeting of the American Dental Association held in California in 1936, I discussed "A Simple Control for Practical Castings." In that presentation, I described some phases of the technic used in producing gold castings which meet dimensional requirements. Since that time, my consideration of the casting problem has been directed to the study of (1) structural defects in finished castings and a method for their reduction, and (2) improved cavity preparation.

We have been so enthusiastic in devising technics for investing, burning out and casting that the most important step has been completely overlooked. With a faulty wax pattern, one could use a perfect technic for meeting dimensional requirements and yet at best meet with failure in the finished casting.

POROSITY IN GOLD CASTINGS

Under the subject of structural defects, I shall discuss shrink-spot porosity. In this type of porosity, voids are caused by a localized shrinkage due to different rates of cooling in different parts of the casting.

In the industrial world, the making of castings has not been without defects, but constant study has been made of the problem of reducing them.

In pouring ingots, one of the most noticeable results of the freezing is a more or less cone-shaped cavity, which is left at the top of the ingot, and known as the pipe. After solidification of the metal is complete, further contraction on cooling tends to open the pipe still farther toward the bottom, because the exterior, being cooler, is more rigid and is capable of stretching or tearing the more plastic interior.

This piping is overcome by the use of what is called a hot-top mold. This mold, which is lined with a refractory, nonconducting material, such as clay, surmounts the upper end of the regular mold and keeps the top of the ingot in the molten state until the ingot proper has solidified. The liquid in the hot-top feeds into the mold and takes care of the natural shrinkage which occurs in metals on freezing. Thus, the pipe is brought up into the sink head and the waste is decreased accordingly.

Where industry has the pipe, dentistry has shrink-spot porosity, which is especially noticeable in sections of the casting adjacent to the sprue. In some cases, it is more deeply embedded in the casting proper. This porosity has the effect of weakening the castings in these sections to a very marked degree. Through experimentation, we have found that this could be largely eliminated by the use of a short sprue of large diameter. The shorter the sprue and the larger the diameter the better.

The reason for using a short, heavy sprue is that the diameter of (for example) a 12-gage sprue chamber is twice that of an 18-gage sprue chamber; the circumference of the former is twice that of the latter, and the area of the larger chamber is four times that of the smaller.

(Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

The appreciable difference in area is to be noted especially, and it is to be understood that in the time required for the 18-gage chamber to freeze, the gold in the larger chamber has frozen to only a depth of one-hundredth inch, with the mush area and molten metal occupying the remainder of the chamber.

Furthermore, the center of the large chamber will remain molten much longer than that of the smaller, because the outer skin of the frozen metal serves as an insulator in retarding the cooling of the interior. The presence of this large body of molten gold in the center of the larger sprue chamber serves a two-fold purpose: (1) to feed molten gold from a reservoir or sprue-button down to the casting proper, for the purpose of filling the voids and reducing shrink-spot porosity, and (2) to furnish the additional heat of the molten gold to keep the entire casting a more uniform temperature while solidifying, thus annealing the casting and reducing the possibilities of internal strains.

How much better it is to reduce these defects at this point in the casting technic than to depend on heat-treating for a cure-all for such mistakes! Heat-treating produces a more uniform crystalline structure and relieves internal strains, but it positively will not eliminate porosity, which is purely a defect caused by faulty casting technic.

Before presenting some graphic illustrations on correct and incorrect spruing, let me suggest that we always place the sprue pin in the largest bulk of wax, as this will be the last point to freeze, and thus we can reduce, as much as possible, the porosity of the casting.

When a small sprue is used, the gold in the sprue chamber has completely solidified before the freezing in the casting proper has been completed, and thus shrink-spot porosity has resulted within the casting. This casting will surely be weakened and poorly annealed, and subject to the possibilities of internal strains.

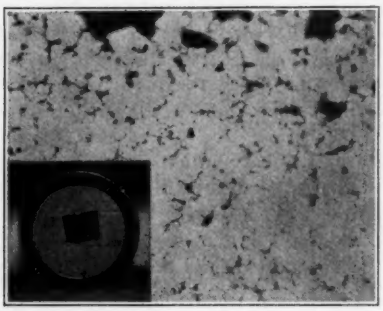

Fig. 1.—Cross-section of plug casting, using 18-gage sprue. The large voids indicate shrink-spot porosity. Porosity was so great as to entirely sever the sprue. (×100.)

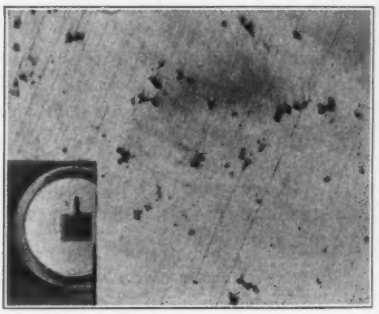

Fig. 2.—Cross-section of plug casting, using 16-gage sprue. There is reduction of shrink-spot porosity as the diameter of the sprue is increased. (×100.)

Some have suggested that these defects can be avoided by placing a small ball of wax on a small sprue, but this will not help matters in the least. The ball of wax being smaller than the heavy portion of wax into which the small sprue has been inserted, the casting will have the same structural defects as encountered in the former casting.

Still another suggestion comes from some who are convinced that the small reservoir does not hold enough reserve molten gold. They advise the use of a larger reservoir, but still insist on using a

long narrow passageway to connect it with the casting proper. With this small passageway, which is more susceptible to freezing, we get the same defects in the casting.

When the large, short sprue with a reservoir sufficiently large is used, we are able to make a casting comparatively free from porosity. As stated before, the molten gold will fill the voids caused by shrinkage and will anneal the casting by keeping the entire body a more uniform temperature during the freezing process.

To substantiate this line of reasoning, a metallographic study of actual gold castings has been made. With plugs which were comparable in volume to the average gold casting and uniform in size, it was possible to show the effects of the different types of spruing on the finished castings. To verify the findings in the plugs, cross-sections of some practical castings were made. In order to get uniform results, a standardized technic was used in making the castings.

The handling of the wax, the investing, the heat-treatment of the mold and the melting and casting of the gold were all carefully controlled. New gold was used in making the castings, which were cross-sectioned with a disk under water to prevent local heating and possible microscopic changes due to such heating. These cross-sections were embedded in a low-fusing metal to furnish support for the lapping operations which are essential in preparing the face of the casting for photomicrographic study. This lapping was done on a special machine built by Professor Weiland and used exclusively for the preparation of all kinds of metals for microscopic study.

Figure 1 shows a photomicrograph of a plug casting which was cast through an 18-gage sprue chamber. The picture (×100) of the casting was taken just below the attachment of the sprue. There are a number of extremely large cavities and a wide distribution of narrow crack-like cavities extending deep into the casting. The porosity in the sprue was so extreme that the sprue was completely severed.

Fig. 3.—Cross-section of plug casting, using two 18-gage sprues. Extreme porosity is evident at the base of the vertical sprue. (×100.)

Fig. 4.—Cross-section of plug casting, using two 18-gage sprues. Extreme porosity is evident at the base of the angle sprue. (×100.)

Figure 2 is a photomicrograph of a similar plug casting having a 16-gage sprue chamber. In this case, the sprue chamber was not severed, but porosity was macroscopic at the attachment to the casting. The decrease in size and number of shrink-spot cavities is evident.

For large castings, multiple sprues have been recommended frequently. Unless these sprues are each of large volume, the defects in the casting will still be prevalent.

Figure 3 is taken at the base of the vertical sprue in a two-sprue plug casting. Porosity is as extreme as, if not more so, when a single 18-gage sprue was used.

Figure 4 is a photomicrograph taken at the base of the angle sprue of the casting shown in Figure 3. Porosity here is almost as marked as that shown in the previous picture.

Figure 5 is a picture of the same casting. This section of the casting is located near the center of the plug and about one-sixteenth inch from the top. Here again, the two small sprues have not decreased the porosity in the casting over the single sprue of the same gage.

So far, we have proved beyond doubt that without a sufficient sprue chamber, the voids will necessarily be in the casting proper. Let us now turn our attention to a practical casting with a large, short sprue chamber and a generous reservoir. (Fig. 6.) This is what I consider a perfect casting with the porosity confined to the reservoir where it belongs. This picture is a photomicrograph taken near the top of the sprue. There is almost complete absence of porosity.

Figure 7 shows an area near the center of the crown on the occlusal aspect. Here again, there is complete absence of porosity. In all areas of this crown, the condition was similar to that shown here.

Figure 8 is a photomicrograph of a cross-section of the reservoir of the casting shown in Figures 6 and 7. Here the shrink-spot porosity has been successfully confined to the reservoir.

Another practical casting of large bulk is shown in Figure 9, with porosity confined to the base of the reservoir. There was complete absence of porosity within the casting proper.

Many of you have probably been working with this problem of the reduction of porosity in casting. To those of you who have not been interested in this phase of the casting problem, I would suggest that you give it serious consideration, for there is every reason to believe that porosity is one of those unseen factors which often mean failure, but which, with a little care, can be rendered negligible.

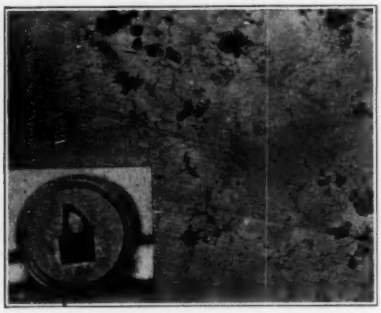

Fig. 5.—Cross-section of plug casting, using two 18-gage sprues; photomicrograph taken at point one-sixteenth inch from top of casting and near center. (×100.)

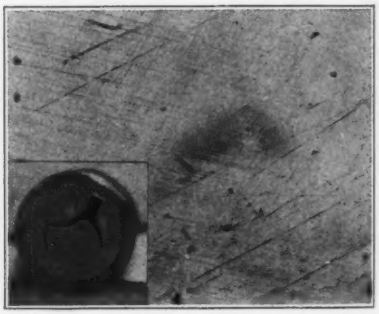

Fig. 6.—Cross-section of full-cast crown, using large sprue; photomicrograph showing lack of porosity throughout sprue. (×100.)

CAVITY PREPARATION

So far, the physical properties of filling materials as they affect the end-result have been considered. The profession has done a great deal of work on filling materials, studying the physical properties and attempting to develop ways and means to control them in an effort to eliminate those which have a detrimental effect on final results.

The remainder of this paper will deal with measures to improve the end-result by a modification of cavity preparation which offsets the deficiencies in physical properties of certain filling materials and improves the mechanical conditions in many ways. The principle involved is not new. As a matter of fact, it has been employed in the industry of pattern making for many years. The application of this principle to dentistry was first suggested to me by Bert L. Hooper, who has given me valuable assistance in preparing this work.

The idea, a very simple one, is illustrated graphically in Figure 10. Instead of the conventional base line angle, as shown at A, a modification illustrated at B lends itself to decided advantages. A slightly rounded effect has been substituted for the sharp baseline angle. I mentioned previously that the principle is not a new one. Figure 11 is taken from a standard textbook on pattern making as used in general industrial work.

Fig. 7.—Cross-section of full cast crown, using large sprue; photomicrograph taken from center of occlusal section. The lack of porosity is evident. (×100.)

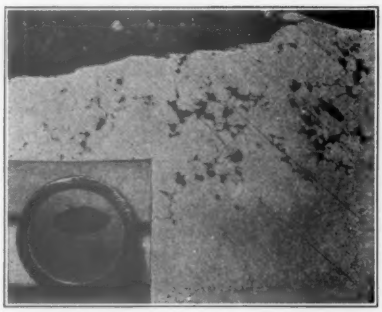

Fig. 8.—Cross-section of sprue button of full cast crown, as in Figures 6 and 7. The porosity is confined to this area. (×100.)

Quoting from this textbook:

> Sharp corners, whether inside or outside a pattern, should be avoided, and whenever possible, all corners should be rounded. Sharp corners on the inside of a pattern form sharp corners when molding, and these give the molder a great deal of trouble. Sharp corners . . . also injure the strength of the casting. As the alloy hardens, the crystals seem to form so that their lines of strength are perpendicular to the faces, as indicated by the lines in the shaded part. This formation leaves an open space or a space of irregular crystallization, at *e*, and the casting is liable to break along the line *df*.

These are basic principles for industry and make for better industrial castings. They are also basic principles for dentistry in some of the problems involved in filling teeth.

Now, let us make the application to cavity preparation and see its advantages in taking the impression and in casting and setting an inlay.

In a simple occlusal cavity prepared in the conventional manner, we shall keep in mind the sharp base line angle, which is made by the union of the outside walls of the cavity with its base. We shall also keep in mind the sharp angle of the pattern shown at B, in Figure 12, left. The modification in cavity preparation previously mentioned presents a change in the base line angle. Instead of having the side walls of the cavity meet the base at a sharp angle, there will be a slightly rounded effect, illustrated at A, in the cavity (Fig. 12, center) and at B, the resultant pattern.

It may be questioned whether this

rounded effect in the base line is detrimental to the inlay because of a slight loss of frictional effect. Our experience leads us to believe that it is not detrimental, but will allow better adaptation of all surfaces of the filling material to the cavity walls, and hence better retention.

In a proximal cavity with an occlusal step having sharp line angles, there are even more complications because there are more line angles to consider. The conventional line angles are as follows: gingivobuccal or gingivolingual, gingivoaxial, axiobuccal or axiolingual, and the base line angle formed by the union of the side walls with the pulpal wall.

A cross-section of a proximal cavity

Fig. 9.—Cross-section of bulky mesioclusodistal inlay, using large sprue; photomicrograph showing confining of porosity at base of reservoir. (×100.)

prepared with the suggested modification is shown in Figure 12, right. Here again, the loss of frictional adaptation is negligible, but it will make a great difference in the drawing of a wax pattern, the investing and the setting of such an inlay. Furthermore, the drawing of a pattern from this preparation will not entail resistance at points A, B and C, thereby insuring a pattern free from distortion. How much of our success or failure is due to wax patterns?

A proximal cavity has axiobuccal and axiolingual angles. With sharp angles, it is difficult to avoid distortions in the wax at these points. The trouble which necessarily accompanies the setting of castings made from these patterns is often exasperating to an operator. He then either drives the casting to place, thus forcing the inlay from its adaptation to the walls and away from the external enamel outline of the cavity, or he rounds off the gold with a stone, which leaves no adaptation in the angles, and he merely fills the angle with cement. How much better it would be to prepare these angles in such a manner that a wax pattern can be invested, cast and set with a minimum of time and a maximum of efficiency!

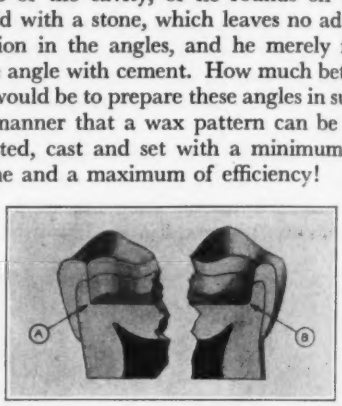

Fig. 10.—Mesiodistal section through upper first molar with Class 1 cavity preparation. A, sharp base angle. B, slightly rounded base angle.

Fig. 11.—Illustration from textbook on pattern making in industrial work.

In a simple cavity in which the angles are sharp, the wax either goes completely into the sharp angle or fails to fill the cavity. In the first instance, when the pattern or impression is being removed, the sharp angle may drag slightly on the side of the cavity and become distorted. (Fig. 13, left.) This slight dragging is often disregarded in the impression technic, with the idea that, in the end, the sharp lips of gold which result can be ground off. But since the dragging of the

wax in this particular area necessitates a forced removal of the pattern, how are we to be sure that the distortion is confined to this part of the wax only?

In considering the wax pattern which fails to fill the sharp angles, suffice it to say that there necessarily would be a faulty adaptation of the inlay to the side walls of such angles; so why the sharp angles at all?

An inlay made from the distorted wax pattern can be seated only to the distorted point. (Fig. 13, left, A.) If this defect could be ground off, and if this were the extent of the distortion, we could be reasonably safe in setting such an inlay. However, there will be lack of adaptation shaving off of a portion of the dentinal wall could occur. (Fig. 13, center, B.) If this happens during the setting of the inlay, these fragments, even though small, will rest on the seat of the cavity (A) and another faulty adaptation result (C), to be remedied again by the "burnishing technic."

So far, we have been dealing with the wax adaptation in the occlusal part of the cavity. A point to consider in the base angles of a step cavity is the possibility of dissolving the cement along the gingivobuccal and gingivolingual line angles. (Fig. 13, right.) These two points are the most vulnerable as regards recurrence of decay. When the impression is taken,

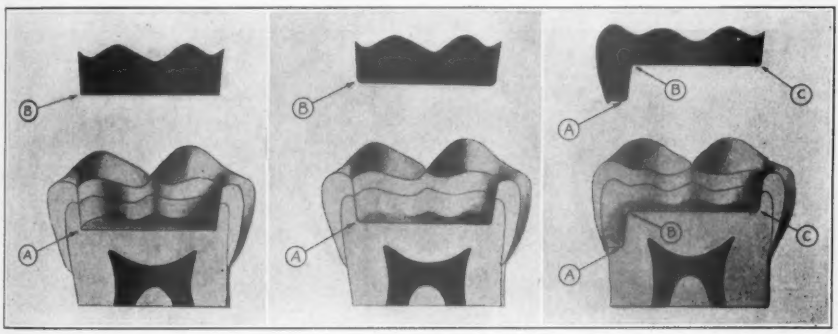

Fig. 12.—Left: Cross-section of cavity, with pattern above, showing conventional sharp line angles. Center: Cross-section of cavity, with pattern above, showing modified angles. Right: Cross-section of cavity with pattern above, showing modified angles.

at point B; and although the gold could, in a fashion, be drawn over or burnished to outline, there would still be poor adaptation along the side walls of the cavity and a heavy layer of cement just below the cavo-surface angle. This burnishing of gold to the margins, instead of casting it to fit, is one great objection to the gold inlay. Lack of adaptability to the cavity wall is the one disadvantage of the inlay which is stressed by all critics.

In seating an inlay, or a bridge with hard gold abutments, with sharp angles, there is every reason to believe that the displacement of enamel rods or even the these angles are the most remote and difficult to obtain. If the angles of the inlay fall short of adaptation into the sharp angles of the cavity (Fig. 13, right, A), the cement will occupy this space. If the cement is but slightly exposed at the surface of the inlay and starts to dissolve, the effect will be much more detrimental, and the larger bulk of cement in the base angle will involve more area and hasten secondary decay.

When carrying out the toilet of the cavity (Fig. 14, left), I have found the rounded baseline a distinct advantage. In the sharp baseline angle at A, it is very

difficult to remove that last bit of débris which finds its way into the angles of the cavity. With the rounded angle at B, we have perfect access, and it will not necessitate the taking of one impression to remove the débris before the final impression.

In placing cement in a cavity with sharp base lines preparatory to setting an inlay, it is easy to trap air in the sharp angle, whereas a slightly rounded effect would solve the problem. This entrapped air tends to make the inlay rebound from its setting, and also causes a void between the inlay and the cavity wall, which means early failure of the restoration. Furthermore, the wedging against the walls of the cavity would have a tendency to block a free passageway for excess cement. With the cavity having the slightly rounded effect, cementation becomes a technical procedure attended by little difficulty. First, the cement can be applied to the cavity walls without fear of bridging, and, secondly, the angles offer no resistance to the escape of excess cement, thus assuring a more perfect adaptation of the inlay to the cavity walls. Even with poorly directed pressure, the inlay will still be free from binding against the side walls as it moves to place.

We have considered the inside line angles. Let us now consider the step cavity with the outside line angle formed by pulpal and axial walls. A pattern from this cavity, of course, contains the impression of the axiopulpal line angle. It is easy to confine air bubbles in this sharp angle, and, in turn, these air holes are cast in gold. If the defect in the casting (the well-known peduncle) were sufficiently large to be noticed (Fig. 14, center, A), we could probably remove it with a bur and be fairly successful in seating the casting; but all operators know how difficult it is to avoid those tiny, almost microscopic, air bubbles on the inside angle of the inlay pattern. One other consideration is the liability to fracture or distortion of the sharp corner of investment, formed at angle A, during casting of the gold into the mold. With these deficiencies in casting technic, the inlay, when tried to place, will present one of two conditions. With the interference at point A, a fulcrum is set up, and when the inlay is adapted at the gingival aspect, it will necessarily come out at the occlusal aspect; or if the inlay is pressed to place on the occlusal surface, poor adaptation at the gingival aspect results.

Some may say that it would be very easy to cut out a portion of the casting at point A; but it is much easier to round this outside angle when preparing the

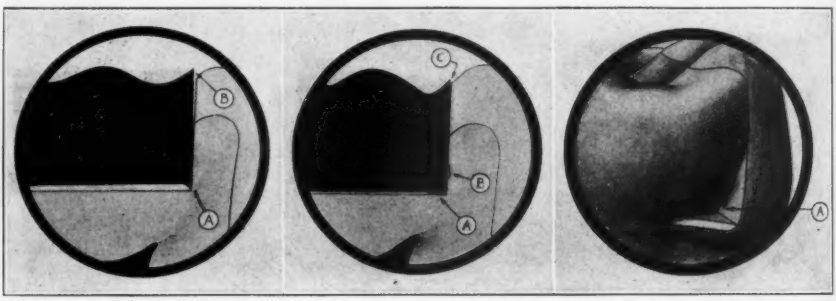

Fig. 13.—Left: Distortion of inlay from drag in removal of wax pattern. Center: Result of shaving dentin from wall by sharp angle of casting. Right: Defect shown at line angles of gingival wall.

cavity. This gives a wax impression which eliminates all the difficulty met in applying the investment and also gives a rounded edge in the mold which will neither fracture nor become distorted under the force necessary to cast gold.

The materials used in making restorations all exhibit properties which do not lend themselves to adaptation in sharp angles formed by cavity walls. While these materials, waxes, compounds, alloys and all plastic filling materials have been very much improved in the last few years, they still cannot perform some of the difficult, or perhaps impossible, things we expect of them. We should establish a condition in cavity preparation which will assist in the better adaptation and maintenance of adaptation to the cavity walls, and the rounded or modified angles will do this very thing.

We have discussed the advantages of the slightly rounded line angles. Now let us see how easy it is to produce them in the preparation of a cavity. These angles are cut with a special bur, which was designed by Dr. Hooper. Its profile, as compared with that of the conventional bur, is shown in Figure 14, right. This bur is now available on the market. (Neither Dr. Hooper nor I have any commercial interest in these cutters.) The entire idea is a contribution to the good of the cause.

Cavities may be prepared entirely by the use of these special cutters; or a cavity may be opened and partially prepared in the conventional manner and the special cutters be used for the final preparation. At least 0.33 to 0.50 mm. in all dimensions of the cavity should be removed with the new cutters. They are especially efficient in flattening the base of the cavity, in view of the fact that there is no sharp edge or angle to cut into or nick the base as the bur is moved from side to side. A smooth, continuous surface throughout the cavity results.

Perhaps, to many of you, this idea is revolutionary; and there may be a question in your minds as to its merit. May I suggest to those of you who are skeptical that you apply the idea in a few cases, or try it experimentally in your laboratory. I predict that, in a very short time, sharp line angles in cavity preparation will be *passé*, with perhaps the exception of cavities prepared for gold foil fillings; and, even in this field, I know of experts who limit materially sharp line angles.

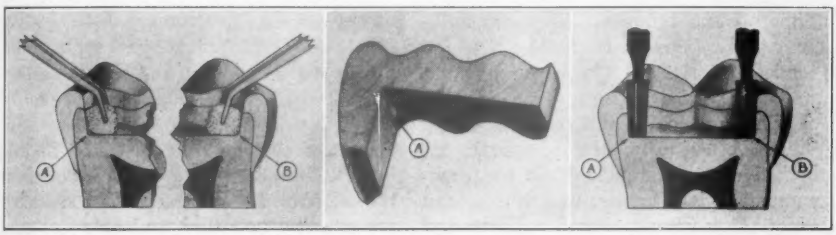

Fig. 14.—Left: Greater advantage in attaining toilet of cavity at B as compared with that afforded by sharp angle at A. Center: Inner side of two surface inlay, with common defect in sharp angle. Rounding and eliminating the sharp angle does not eliminate these defects. Right: Comparison of Hooper base angle cutter with conventional bur, in shaping of angles.

VINYL ETHER (VINETHENE) FOR DENTAL SURGERY: A REPORT ON EXPERIENCES WITH FIVE HUNDRED CASES

By M. Hillel Feldman,* D.D.S., and Samuel Cartin,† D.D.S., New York City

SINCE the discovery of vinyl ether by Semmler, in 1887, little work has been done regarding its use as an anesthetic until recently. In 1931, Ruigh and Major prepared the pure drug. They did considerable work with the anesthetic on animals. The pharmacologic and anesthetic properties were studied by Knoefel, Guedel and Leake. The vapor pressure and other properties were determined by Miles and Menzies and by Smyth and Walls. After using the anesthetic on themselves, Gelfan and Bell, in 1931, recommended its further trial on human beings. Goldschmidt, Ravdin, Leake and others showed the anesthetic potency of vinyl ether in man to be seven times that of ethyl ether. Their studies on dogs and monkeys are of considerable interest. Bourne continued the study of its use in obstetrics. Additional study and clinical experience was recorded by Beach.

Five hundred cases of vinethene anesthesia were studied in making this report, the purpose of which is to acquaint the dental profession with the value of vinethene as an inhalation anesthetic for short surgical procedures.

CHEMICAL AND PHYSICAL PROPERTIES

Vinethene is a clear, practically colorless liquid, showing a slightly purplish fluorescence and possessing a characteristic odor of garlic. It is prepared by the reaction of dichloro-ethyl ether and heated caustic alkalis. It may be considered a cross between ethylene and ethyl ether. A boiling point between 28 and 31° C. makes it a very volatile substance. It is highly inflammable and is about as explosive as ether, although less so than ethylene. Its vapor is denser than air. On exposure to light and air, it decomposes rapidly to form aldehydes, one of which is formaldehyde. Vinethene contains: 96.49 per cent of pure divinyl ether $(Ch_2:Ch)_2:O$; 3.5 per cent of absolute alcohol, for the purpose of reducing the extreme volatility, and 0.01 per cent of phenylalphanaphthylamine, for the purpose of decreasing the rapidity of oxidation. Contamination with the minutest trace of acid will cause decomposition. Vinethene should be kept in dark colored tightly stoppered glass bottles, and stored in a cool, dry place. Unopened bottles, if properly stored, may be kept for one year without deterioration. Opened bottles must be used within twenty-four hours.

PHARMACOLOGY

Since vinethene is so much more potent than ethyl ether, the concentration necessary to induce anesthesia is correspondingly less. In safe concentrations, the comparative potency of vinethene as compared to other anesthetic agents is as follows: for nitrous oxide, 15 per cent; for ethylene, 25 per cent, and for vinethene, 100 per cent. Molitor, who made extensive studies of the effect of vin-

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ethene on mice, concluded that the toxicity of ethyl ether and of vinyl ether was equal. It does not undergo chemical changes while in the body tissues. It is an inhalation anesthetic, nonirritating to the air passages. A vinethene induction is almost as rapid as that of cyclopropane. Recovery is much more rapid than from the more slowly acting anesthetics. The bleeding time and the coagulation time of the blood are unchanged. Excessive sweating and salivation may ensue. Postanesthetic vomiting and nausea rarely occur. As with other anesthetics, consideration should be given to age, cardiovascular disease, kidney disease and pathologic conditions of the liver. According to Bourne and Raginisky, the toxic action on the liver is negligible when the anesthetic is properly administered. Cases have been recorded in which the anesthesia lasted more than two and one half hours without detrimental effects on the liver. It is evident that no untoward liver degeneration will occur during dental anesthesia.

VINETHENE ANESTHESIA

Induction of anesthesia is rapid, averaging from thirty to sixty seconds after the first inhalation in adults, and even less for children. Induction must never be pushed. Because of its rapid action, special precautions are needed in the administration of vinethene, for it is easy to pass from the level of surgical anesthesia to that of a dangerous overdose. The patient must be closely watched throughout the entire period of narcosis. With overdosage, respiratory depression precedes cardiovascular depression. Cyanosis and anoxemia call for the prompt administration of artificial respiration; oxygen, carbon dioxide and respiratory stimulants being given in the order named, to restore the depressed activity of the respiratory center. Major reliance should be placed on artificial respiration with oxygen and carbon dioxide, administered during each inspiration by means of a face inhaler.

The eye signs are unreliable as anesthetic guides and are to be disregarded. The eyelids and eyeballs may respond to stimuli in a manner suggestive of light anesthesia, although the muscular relaxation may be sufficient for surgery. Pupillary reactions are irregular with frequent changes in size. Dilation of the pupil is a sign of danger and is to be avoided. In the longer cases of anesthesia, the eye signs may eventually correspond to those ordinarily seen in ether anesthesia.

As a rule, the first sign of anesthesia is manifested by a flushing of the face. The most important guides in anesthesia are the respiration, pulse and blood pressure. During anesthesia, respiration becomes faster, shallow and rhythmical. Respiration is the most important anesthetic sign. Regular breathing should be the aim of the anesthetist. The pulse, as the patient sinks into narcosis, becomes slower, regular and of equal volume. It is possible to be guided by pulse observation alone. A slight excitement stage may occur, but is of short duration. Previous to the first plane of anesthesia, swallowing may occur. Relaxation is the general rule. Cyanosis, of course, must be avoided. The maintenance of the anesthesia is dependent on the proper use of a well-placed oral pack. Mouth breathing, however slight, will interfere with the efficiency of the anesthetic agent. In determining the stage of narcosis, it will be found helpful to have the patient count or move a hand in time with the count of the anesthetist. When the patient can no longer follow the count of the anesthetist, unconsciousness is assured. With the skill gained by experience, it is possible to make the administration of the vinethene correspond with the length of the operation.

When administering vinethene, if the cap and wick type of bottle is used, the wick should be about one-eighth inch in

length. It should be kept almost in contact with the mask. The rate of flow is affected by the tilt of the bottle and the humidity and temperature of the room. The ideal rate of flow varies between 80 and 100 drops per minute. Too rapid induction causes coughing and a feeling of suffocation, which may be avoided by decreasing the rate of flow at the first signs of irritation.

ADMINISTRATION FOR SHORT DENTAL OPERATIONS

The patient is prepared as for a nitrous oxide anesthesia. The ankles are crossed, and the hands clasped in the lap. Restraining straps are kept ready in case of necessity. A mouth prop should always be inserted before administration of the anesthetic is started. After the prop is in position, the mouth and nose are covered by four to six thicknesses of coarse gauze measuring 6 inches square. The chin is supported by placing the fifth finger at the angle of the mandible, the fourth finger under the lower border of the body of the mandible, the third finger under the symphysis, the second finger under the lower lip and the thumb on the bridge of the nose. The anesthetic agent is allowed to drip on the mask between the second finger and the thumb. When the patient is ready, the bottom of the mask is rolled up until it rests on the upper lip, covering the nostrils lightly and leaving the field of operation free. If it is desired to prolong the time of anesthesia, the gauze roll is kept moist. Inasmuch as the masseter muscles relax during the surgical stage, obstreperous children and nervous persons may be anesthetized and the mouth opened with a tongue depressor previous to the operation.

A second method of administration requires the use of an ether mask covered with four to six thicknesses of coarse gauze. The mask is applied to the face, covering the nose and mouth. When the patient is ready, the mask is lifted away from the mouth and is retained only over the nose. The anesthesia may be prolonged by keeping the portion of the mask over the nose wet with vinethene. It is expected that a properly designed nasal inhaler will eliminate the waste that occurs with the above-mentioned technics. Some work has already been done in the use of a nasal inhaler, and it is indicated that it will supplant other open methods of induction and maintenance.

The closed method of administration as used will be described and discussed briefly. Four methods are at the disposal of the anesthetist:

1. Induction by the open method followed by maintenance with nitrous oxide and oxygen.
2. Nitrous oxide and oxygen anesthesia with vinethene as a synergist.
3. The use of oxygen and vinethene augmented with nitrous oxide.
4. Vinethene and oxygen anesthesia.

In the first method, anesthesia is induced with an open mask and is maintained with nitrous oxide and oxygen. For the nervous type of patient, this is an ideal way to secure a rapid induction without undue apprehension. For the remaining methods, the contents of a 25 cc. bottle of vinethene is placed in the ether vaporizer of the anesthesia machine. When nitrous oxide and oxygen are used, vinethene may be given as a synergist. This has proved to be a very effective method. Vinethene may be administered with oxygen alone, or it may be given with oxygen and nitrous oxide. The last two methods are not recommended for dental use.

CLINICAL OBSERVATIONS

An operating time of from thirty to ninety seconds could be expected from the moment the vinethene ceased to flow to the moment when the patient became aware of pain. There was a definite period of analgesia. By continuing admin-

istration during the operation, the surgical time could be increased. At any indication of deepening of anesthesia, the rate of flow was decreased or the flow was entirely stopped. After removal of the vinethene, the depth of the narcosis began to lighten. Consciousness began to return immediately on cessation of the flow. On one occasion, two maxillary molars and the adjacent bicuspids were extracted while the patient was in the analgesic stage. It was often possible to extract or to perform surgical procedures without having the patient past the analgesic stage. Recovery was rapid. All patients were in a condition to leave the clinic immediately after leaving the chair. A few patients were slightly dizzy or sleepy for a few minutes. A sensation of numbness in the extremities occurred in certain cases. These manifestations disappeared by the time the patient left the room. Nausea and vomiting were conspicuous by their absence. Micturation occurred once in a child of 5, undoubtedly as a result of fear.

A heavy smoker, a man of 37, somewhat plethoric and weighing about 185 pounds, was prepared for an anesthetic with vinethene to be used for a synergist. The patient had taken no more than two breaths of the nitrous oxide when he began to struggle and to make efforts to remove the face inhaler. The mask was immediately removed. The patient explained that he had suffered a broken nose and had had difficulty in breathing ever since. To prevent any further demonstration and to learn whether the patient would prove amenable, the open drop method of administration was tried with admirable success. The patient was calm, anesthesia being induced smoothly and quietly within forty seconds, for an operative time of a minute, which was maintained by keeping the mask wet as it was being held over the nose. The patient recovered immediately on the removal of the mask, and in a tranquil state of mind.

Certain types of patients generally considered difficult to handle under nitrous oxide proved perfectly amenable under vinethene. These types included: obstreperous children and nervous, neurotic, red-headed, blonde, colored, athletic and plethoric patients, as well as excessive users of tobacco and alcohol. Age does not seem to be a counterindication. Premedication was never found necessary. The potency of the drug eliminated any necessity for forcing anesthesia. There was no record of an unsuccessful case which could be attributed to the anesthetic *per se*. Those failures which occurred were due to unskilful technic, correction of which resulted in perfect anesthesia. To insure satisfactory anesthesia, observance of the following will be helpful: The bottle of vinethene should be warmed in a glass of moderately warm water for about thirty seconds if the temperature of the room is much below 80° F. This will insure an adequate flow. The drops should be almost in contact with the mask before they fall. This will help to vaporize the agent into the mask and will prevent vaporization into the air. After the operation, the mouth prop should be left in place until the patient fully recovers. Rarely, on recovery, a short excitement period may occur which is more of a hysterical nature.

Previous to the operation, an oral pack was always inserted. Not only did it prevent mouth breathing, but it also prevented débris, saliva and blood from entering the throat. Owing to the excessive salivation which often occurred, small gauze sponges were kept ready for use in soaking up the moisture. The use of suction, of course, is ideal. In operations involving the mandible, the oral pack is inserted and a gauze sponge is placed between the tongue and the teeth in smooth swift motions. For surgery of the maxillae, the oral pack alone will suffice. The practice of operating without protecting the throat is to be discouraged.

Recently, a dentist was faced with the

problem of removing a number of embedded supernumerary teeth in the anterior portion of the maxillae of a boy of 9. Two previous attempts were made, but each resulted in failure because the child could not be managed. When brought to the clinic, the child was seated in the chair and an ether mask was placed over his face. The vinethene was administered freely. Within ten seconds, the patient was under control. The operation was started within twenty seconds after the first inhalation. The patient was under the anesthetic for eight minutes. The recovery was uneventful.

Weak and debilitated patients favor vinethene anesthesia because of the rapidity of induction, the speed of recovery and the lack of nausea and vomiting. Such a patient was seen in the hospital ward suffering from a high fever (103° F.), which was partially attributed to the presence of abscessed roots. Six maxillary molar roots were extracted in an anesthetic time of a few minutes. The patient was in bed reading a newspaper when seen five minutes later.

Wesley Bourne, in his study of the coagulation time of the blood after vinyl ether anesthesia, concluded that the time remained unchanged as compared to the coagulation time previous to the anesthesia. In our own clinical cases, we never found bleeding during or after an operation to be other than normal. As no cases of postoperative hemorrhage were ever observed, records were not kept regarding the bleeding and coagulation time.

To those unacquainted with the eye signs of vinethene anesthesia, it seems strange that a patient is in a satisfactory plane of narcosis while to all outward appearances he is awake. The 10 cc. bottle and an open ether mask will provide an excellent means of obtaining general anesthesia for the practitioner who may occasionally require the use of an inhalation anesthesia.

The following observations were made by patients and also by one of us who acted as a patient from time to time in order to study the effects of vinethene anesthesia:

1. Too great an initial concentration induced a sensation of suffocation, coughing and a desire to remove the mask.
2. A few softly spoken words encouraged the patient and made him less apprehensive.
3. Having the patient count helps the anesthetist to determine the anesthetic plane.
4. The first sensations were a tingling of the body, especially in the lips and tongue, and then a whirling, ringing sensation followed by blackness as consciousness was lost.
5. Recovery was natural as if from a sound sleep.
6. Dreams, sometimes erotic in nature, were noted by some.
7. The odor was not unpleasant to the patients.

ADVANTAGES

As a general anesthetic, for dental surgery, vinethene has certain advantages:

1. The armamentarium is simple.
2. There is no psychic shock.
3. There is ease of administration.
4. Induction is rapid and smooth.
5. Elimination is so rapid that patients are immediately ambulant.
6. Postanesthetic nausea and vomiting rarely occur.
7. An analgesic period of considerable length may be expected.
8. Patients do not find it unpleasant.
9. As it is nonirritating to the respiratory tract, coughing due to irritation rarely occurs during induction except when too much is being administered.
10. It does not have a tendency to produce tonic or clonic spasms of the respiratory muscles.
11. Breath holding does not occur as is often the case under deep ethyl chloride anesthesia.
12. Obstreperous children are quickly

anesthetized, and thus the atmosphere of the office is tranquil.

13. Mouth props, which should commonly be used, may be discarded in the case of an obstreperous child or nervous adult.

14. Unlike ethyl chloride, its effect is not cumulative and therefore it may be used for longer periods with greater safety.

15. Unlike the anesthesia of ethyl chloride, vinethene anesthesia does not deepen after the agent is removed.

16. As a synergist to nitrous oxide, it provides for a rapid induction with increased relaxation, without increasing the tendency toward undesirable anoxemia.

17. The excitement period, if any, has always been of short duration.

18. For surgical procedures lasting less than ninety seconds, it is an ideal anesthetic agent.

19. Premedication is not needed.

20. Postanesthetic calm is the rule even when the patient is preanesthetically nervous, obstreperous, etc.

21. It affords a pleasing anesthesia for home or hospital use.

DISADVANTAGES

The disadvantages include the following:

1. The high temperatures which occur during the summer months may interfere with the open-drop method of administration because of the high volatility.

2. During the colder months, if the cap and wick type of bottle is used, difficulty will be encountered in securing an adequate flow.

3. Continued use of the agent in a small room may affect the anesthetist and those in the room, resulting in a headache and a feeling of sickness, unless a suitable technic is followed.

4. Dangerous overdosage is difficult to detect.

5. Light and air quickly decompose vinethene.

6. Anesthesia is difficult to maintain for a long time because of the narrow anesthetic range.

7. There is a lack of gross anesthetic signs.

8. The range between light anesthesia and overdosage is very narrow.

9. Excessive salivation frequently occurs.

SUMMARY

Children and pregnant women were given vinethene routinely. The clerk was instructed to seat adults in the order in which they were registered. Vinethene was given to all patients except those considered risks for a general anesthetic. Efforts were later made to select patients usually considered to be difficult to manage under nitrous oxide and oxygen. Patients had not been previously seen nor previously examined. The time of the patient's last meal was unknown to the anesthetist, nor were the patients directed to the lavatory. Every effort was made to give the anesthetic agent the severest possible clinical test, one which would amply cover any situation that might arise in the office of the general practitioner.

Vinethene was administered to 500 dental patients varying in age from 4 to 75 years. This number included, by the open method of administration, 214 children; 156 average patients; fifteen pregnant women with pregnancies of from two to eight and a half months; twenty-one athletes; nineteen smokers; five alcoholics; eight plethoric persons, and one neurotic patient. The closed method was used sixty-one times. In thirty-five of these cases, vinethene was used as a synergist to nitrous oxide and oxygen. The longest operation lasted ten minutes.

Operative procedures included:

1. Extraction of from one to eight teeth.

2. Extraction of embedded supernumerary teeth.

3. Extraction with a flap technic.

4. Extraction with curettage.
5. Curettage.
6. Incision and drainage.
7. Alveolectomy.
8. The Feldman drill technic for the removal of roots and lower molars, especially partially impacted third molars.

CONCLUSION

The introduction of vinethene as an inhalation anesthetic into dental practice provides the profession with a safe general anesthetic for short surgical procedures. Its ease of administration relieves the dentist of the difficulties encountered with other agents, whereas the rapidity of recovery enables him to dismiss his patients as rapidly as when procaine is used. The many cases of infection which prohibit the use of procaine may be handled with facility under vinethene. The open-drop method of administration is recommended. Our study of vinethene indicates that it has a definite place as a dental anesthetic. We find it compares favorably with anesthetics now in use. As a synergist to nitrous oxide and oxygen, it merits additional study. The practitioner who familiarizes himself with vinethene will find it to be a valuable addition to his assemblage of anesthetic agents.

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730 Fifth Avenue.

MULTIPLE DENTIGEROUS CYSTS IN FOUR MEMBERS OF ONE FAMILY

By J. Reese Beyrent, D.D.S., Steelton, Pa.

IN presenting this case, we do so mainly because of its value as a matter of record, as we have found few data in the dental literature concerning multiple dentigerous cysts in several members of one family. In this case, at least four members of a family have had dentigerous cysts, two members having four cystic areas each, and the third and fourth members, one each such area. One child has had four cysts involving the mandible; a second child, two in the mandible and two in the maxilla; a third and a fourth child, one each in the mandible. The size of these areas vary from about 8 mm. to more than 30 mm. The fourth child, now 9 years old, was watched closely for six months for any sign of additions to the already large number of cystic areas found. September 20, 1937, roentgenographic examination revealed a developing cystic area.

Fig. 1 (Case 1).—Right side of mandible three years after operation. Some malformation can still be seen.

REPORT OF CASES

Case 1.—E., a girl, aged 12, came to the office, June 1, 1933, for relief of pain. Large swellings were found involving both sides of the mandible. The right side was almost three times normal size; the left, enlarged to some degree.

Roentgenographic examination of the left side of the mandible disclosed a cystic area with the lateral incisor, cuspid and first bicuspid on the floor of a cyst. The right side showed a bicuspid on the floor of a cyst. The cysts occupied most of the body and right ramus of the mandible. The cysts were lined with some slight remaining malformation. (Fig. 1.)

CASE 2.—J., a boy, aged 12, was sent to the office, March 2, 1937, by a school teacher because of the enlargement of the jaw on the right side. Roentgenographic examination revealed a condition similar to that of his sister E. (Case 1.) Complete examination

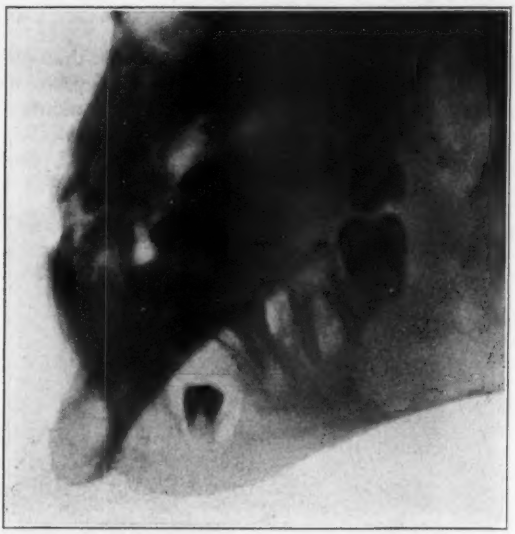

Fig. 2 (Case 2).—Cystic areas in lower right mandible.

Fig. 3 (Case 2).—Upper right and left cuspid regions.

thin epithelial membrane and contained yellowish fluid.

Robert H. Ivy, of Philadelphia, operated on this case, June 27, 1933. Roentgenograms taken three years later reveal revealed four cystic areas. The lower right first molar region showed a cyst involving the molar area and extending well up into the ramus. The cystic area appeared as large as a walnut. The right first bicuspid region contained a cyst the size of a dime. The upper right and left cuspid areas contained large cystic areas with cuspids high in the bone and not moving into position normally. These findings led us to examine all members of the family.

CASE 3.—B. J., a girl, aged 10, on examination, March 4, 1937, showed a large cystic area in the lower left cuspid and bicuspid region. The area appears to be about 12 by 15 mm. At the lower border of the cystic area, a cuspid tooth was found in very bad alinement.

CASE 4.—G., a girl, aged 9, on roentgeno-

graphic examination, Sept. 20, 1937, showed a small cystic area, about 8 mm. wide. This area was suspected six months previously and the case had been watched since that time. The lower left first bicuspid area shows a small cyst between the erupting bicuspid and the retained deciduous tooth. This case will be observed closely in order to detect formation of any additional areas.

The three remaining children, two boys, aged 19 and 17, and a girl, aged 14, show no apparent trouble. Examination of the parents was also negative.

15 Front Street.

Fig. 4 (Case 3).—Lower left mandible containing large cystic area.

Fig. 5 (Case 3).—Intra-oral view of cystic area shown in Figure 4.

Fig. 6 (Case 4).—Lower left mandible showing cystic area.

DENTAL PERIODICAL ABBREVIATIONS

By JOSEPHINE P. HUNT,* Chicago, Ill.

FROM time to time, suggestions have appeared in the dental literature for more nearly uniform abbreviations of the names of dental periodicals, particularly American dental periodicals. Uniformity is, of course, to be desired, and with many of the suggestions offered, there could be no disagreement. Others are worthy of serious consideration, but the tendency seems to be to make the abbreviations too short.

In no case has any recognition been given the fact that there might be a distinction between the abbreviations which could logically be used in an index or catalog and those which would be suitable and understandable in citations connected with an article. In an index or catalog, much space is saved by short abbreviations and these can be readily identified through the use of the key in the front of the index. The work of making an index is usually done by those familiar with the names of periodicals, and abbreviations are not apt to be incorrect.

With a list of references used in connection with an article, the situation is very different. In the first place, the magazine may have a world-wide circle of readers, and reference abbreviations should be sufficiently comprehensive that even those who are not familiar with the title of the magazine can readily determine what words are intended. Also, in preparing a manuscript, the author frequently writes in long hand and then has the material typewritten by an assistant or a stenographer who is not familiar with the names of the periodicals to which he refers. If his writing is not entirely legible, mistakes are thus apt to occur. In a very short abbreviation, a mistake in a single letter may make identification of the title of the magazine exceedingly difficult.

Not long ago, in a magazine which has published many suggestions for the improvement of dental literature and periodicals, the abbreviation "D.J.J." was found. This abbreviation looked quite simple, but after exhaustive research, no magazine was found which might be thus abbreviated. Finally, by a process of comparing volume numbers, it was determined that "D.I.I.," representing *Dental Items of Interest,* was the intended abbreviation. Probably the author had made his I's somewhat like J's and some one unfamiliar with the dental literature had so interpreted them. If a little fuller abbreviation had been used, the mistake would not have occurred.

There seems to be a misunderstanding on the part of many dentists as to what should be included in a bibliography. Sometimes, a bibliography is a comprehensive list of articles or books and so is really a catalog of the literature on a certain subject. This is what is called a "comprehensive bibliography," and such a bibliography is not usually published in connection with an article. When a comprehensive bibliography appears with an article, some such heading as "Supplementary Reading List" should be given it. The bibliography or list of references accompanying a magazine article is sup-

*Librarian of the American Dental Association.

posed to contain references which have been carefully selected by the author and which have been actually referred to in his paper. When a bibliography is short and well selected and contains only worth-while citations, it seems desirable that the abbreviations be sufficiently complete that the magazines referred to can be readily identified. If the reference is not sufficiently worth while to justify the space necessary for its easy identification, the reference might better be omitted altogether. Incomplete or incorrect references may be excellent for developing the acumen of the reader, but, after all, this is not the primary purpose of a bibliography.

In one list of recommended abbreviations, entitled "Journals and Their Abbreviations,"[1] the actual names of states are abbreviated almost beyond recognition and yet the word "state" is written out. This word "state" is not important, but the actual name of the state is very important and should be written in full. Which conveys the more meaning, "O. State Dent. Soc. Bull." or "Ohio S. Dent. Soc. Bull."? In the same list, the word "Pennsylvania" is abbreviated to "Penn.," but the author has become confused in his own abbreviations, as the abbreviation for "Penn Dental Journal" is given as "Penn. Dent. J."

In another list, the suggestion for the abbreviation of "college" is "col."[2] To a dental student, this abbreviation would probably suggest the right word; to the colored man, it would probably indicate "colored," and to a foreigner, it might easily stand for some such word as "Columbia." The suggested abbreviation of "American" is "Am." and the abbreviation of "Annals" is "Ann." References already have been met with in which "Ann." was intended and "Am." was written. It seems that a better abbreviation for "American" would be "Amer." or else "Annals" should be written in full.

In a U. S. Government publication entitled "Suggestions to Authors,"[3] there is a list of magazine title abbreviations (pp. 22-29) which is worthy of study. These abbreviations have been in use by the United States Geological Survey for many years and have proved satisfactory. Particular attention is called to the statement just proceding the list: "Geographic names and other proper names are written in full."

It is good judgment to make abbreviations uniform for the sake of clarity, but there is little to be gained by making abbreviations obscure in order to achieve uniformity. Uniformity is only a means to an end. It is not a goal in itself. In our journals, let us have carefully selected, easily identifiable and sufficiently complete references.[3]

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*In deference to the wish of the dental profession to control its literature, *The Dental Cosmos*, founded in 1859, was transferred by the publishers as a gift to the American Dental Association, January 1937.

Editorial Department

DENTAL ETHICS

THE subject of dental ethics has received consideration ever since dentistry was a profession. In fact, it was largely a recognition of its ethical relationships that established dentistry as a professional calling.

We believe that it was as early as 1863 that the American Dental Association first formulated a code of ethics to govern its members. From that time to the present, this code has at various times been revised. A notable revision was made in 1909 in the Illinois State Dental Society code, and in 1922 the same revision was made in the code of the American Dental Association.

It was on these dates that, for the first time, a provision was introduced in the dental code making it unprofessional for a member to pay or receive commissions on referred practice; i.e., if a general practitioner should refer a patient to a specialist for service, and if the specialist should pay a commission to the practitioner for this favor, or if a practitioner should

accept such a commission, the transaction was deemed unprofessional, and either party or both parties to the transaction could be expelled from the society.

The principle of this provision when analyzed and accepted as a tenet of our professional faith probably did more to establish dentistry as a profession than any other single circumstance, and, as far as we are aware, this action took place before any such provision was ever passed in the councils of medicine.

The thing that chiefly distinguishes professional men from tradesmen is embodied in the provisions of the code, and this fact should be constantly drilled into every student in a professional school. The fundamental reasons for each provision of the code have frequently been elaborated in our literature and need not receive emphasis here, but they are the first things that should be taught to a dental student as he matriculates. Yet, paradoxically enough, it is safe to say that no student of dentistry or medicine can ever gain a clear conception of applied ethics while in the process of pursuing his studies in college. The boy or girl may have a good mind and be possessed of noble impulses, but this is not enough for the development of the higher essence of ethics. Not till the student has been confronted in practice with the drawn face of agony in a patient and been given the baptism of fire by being obliged to witness such human suffering; and then not till he has been able by virtue of the knowledge he has gained in his studies to bring relief to his patient, not till he has been consecrated by the transformation from suffering to relief and seen this same face relax and the patient settle down into the blessed balm of sleep while the overwrought attendants are tip-toeing about the room in silent sympathy with the sufferer; not till this human drama of pain and relief, of sorrow and beneficence, has been enacted before his very eyes can the student gain a vision or even get a glimpse of the real essence of what ethical relationship may mean.

Some one has said, "It takes a lot of living to make a house a home," and in the same category we may say that it takes a lot of suffering to sanctify a soul. If youth has its promise, experience has its reward, and neither the one nor the other can afford to be vainglorious or presumptuous in the situation.

Professional ethics reaches deeper than a written code. Attitude, behavior, demeanor may mean more than a prescribed provision. A shrug of the shoulder, the lifting of an eyebrow may signify more than a written word. Not only that, but perfect silence may be eloquently unethical. If a

man refuses to speak when something should be said in the righting of a wrong, that man is guilty of a gross violation of the essence of ethics.

The things men do or do not do constitute as fundamental an operation of ethics as the things they say. After all, it is the heart and soul of the individual that governs his ethics, and to bring the matter down to its ultimate analysis, it is really the way a man thinks that constitutes his ethics. If a man in his heart thinks right, he is ethical.

While codes may be necessary for the guidance of the beginner, and while it is perfectly proper for us to have them, no man was ever consecrated to righteousness or right living by signing a code. It may aid in the general conduct of the individual and prevent overt acts to establish a code, but it does not change the nature of the man. And, after all, it is the nature of the man that counts.

OCCLUSION—TRAUMATIC AND OTHERWISE

It has become recognized and accepted as axiomatic in dentistry that proper occlusion is the functional motif of all dental practice. It has also become recognized and accepted as incontrovertibly true, if not axiomatic, that proper occlusion is the *sine qua non* of mastication and hence an indispensable factor in the maintenance of the nutritional requirements of the body.

While the necessity, or rather desirability, of occlusion has long been recognized as essential in the proper functioning of artificial substitutes for the natural teeth, it is only in comparatively recent years that it has become recognized as essential to practically every restorative procedure performed by the dentist. The influence of occlusion in the development of the denture, as well as in the development of the organs and features contiguous to the teeth, has emphasized its importance from the biologic point of view and has contributed largely to the development of the biologic concept of dentistry.

It is interesting to note, however, how far away from the biologic concept the mechanical trend led us in the early days of dental practice. It was the recognition of the disturbance of the function of mastication occasioned by the loss or malposition of the dental units that directed attention to the desirability of correcting irregularities of the teeth and directly gave rise to the specialty of orthodontia. And in turn it was the

specialty of orthodontia that brought us to a realization of the importance of occlusion of the so-called normal denture, as well as the restoration of a denture crippled or incapacitated through loss of some of its essential units.

The orthodontist soon found that teeth could be moved about at will, but in the endeavor to explain the difficulty of keeping teeth in new positions, it was discovered that occlusion was the position-determining factor and a factor that practically delimited the activities of the orthodontist.

Oppenheim's epoch-making contribution to the phenomena of tooth movement explained why teeth could be so readily moved and how Nature compensated for the movement, and also indicated the rapidity with which teeth could be moved and the limitations thereof. The question of the rapidity with which teeth may be moved is still a moot one; many orthodontists have moved teeth so slowly that they have exhausted the patience and, in some instances, the resources of the patient, while others have moved the teeth so rapidly that they have caused irreparable injury to the teeth and surrounding tissues.

In our February issue we published the results of a series of experimental researches on the periodontium by Dr. E. D. Coolidge which should incontestably determine for all time the limitations of tooth movement and the speed at which teeth may be moved without harmful effects upon the investing tissues, particularly the periodontium. Dr. Coolidge's work, done in the meticulous and scientific manner that is characteristic of the real scientist, not only confirms Oppenheim's earlier work, but opens the way for explanation of many of the pathologic phenomena that occur in the mouth as the result of efforts to adapt malpositioned teeth to the demands of functional occlusion.

Dr. Coolidge reports the astonishing discovery, confirmed by many experimental studies, that the cementum of the malocclused tooth may suffer sliver-like fractures under stress of mastication which may eventually result in permanent harm to the periodontium; he also shows that too rapid movement of the teeth may cause the death of periodontal tissue from strangulation. However, in the mouths of youths, and under the normal healthy resistance of the tissues, harmful results are not apt to occur, and here is where diagnostic acumen and clinical judgment must come to the rescue of the operator.

Incidentally, let us hasten to say that when we use the term *periodontium,* we do not mean all the investing tissues of the teeth—we mean the pericementum, the periodontal tissue, the so-called peridental mem-

brane. When the investing tissues as a whole—the gums, the peridental membrane (periodontium) and the alveolar bone—are meant, we use the term *parodontium.*

There is another phase of dental disease upon which Dr. Coolidge's work may have a definite bearing, but one which we only note *en passant,* and in the presence of which we tread lightly and with exceeding caution. We refer to that dread disease which has been called so many names—some of which are unprintable—but which we all recognize when designated as pyorrhea. There is not the slightest doubt in our mind that many of our present-day procedures in correcting occlusion can and do perpetrate insults to the investing tissues of the teeth that hasten the pyorrhea susceptible stage.

The potentialities for evil inherent in indiscriminate and unwarranted interference with the natural, if not normal, occlusal relations of the teeth certainly deserve more serious thought and consideration than they have received in the past from many practitioners.

If the specialties of orthodontia and periodontia had done nothing more than awaken an appreciation of the vital relation of occlusion to the proper functioning of the masticatory apparatus, they would have more than justified their existence as specialties. But orthodontia and periodontia have done much more than that. Without attempting to record all of the notable contributions which these two specialties have made to the practice of dentistry, we would only note in passing, and for the purpose of our present argumentation, that they have directly and indirectly stimulated efforts which have resulted in the clarification and solution of many histologic dental problems that sorely needed clarification and solution.

It was Oppenheim's notable contribution to the pathohistology of the tooth tissues concerned in correcting irregularities of the teeth that justified the corrective efforts of the orthodontist, and also pointed the way to a research into the histologic field that marks one of the most conspicuous advances that orthodontia has made in placing the remedial movement of teeth upon a scientific histologic basis.

But of equal importance and of equal seriousness in consequences is the movement of the teeth under stress of mastication by virtue of their malrelation to the other teeth of the jaws. And here is where the studies of the periodontist have done so much to place the operative phase of dentistry upon a sounder and more scientific basis.

L. P. A.

COUNCIL ON DENTAL THERAPEUTICS

DR. GORDON AND THE COUNCIL ON DENTAL THERAPEUTICS

THE Council on Dental Therapeutics has just completed its first and most important epoch and is now at the beginning of a new period. The Council is unanimous in its appreciation of the monumental accomplishments in the pioneering of this early work by its dynamic secretary, Dr. Samuel M. Gordon. While his resignation will prove a great loss to our profession, it was to be anticipated that one of his energy and ability could not be retained forever where of necessity there had to be notable budgetary limitations. He was offered and has accepted a much larger salary. To wish him success in his new position is but a formality since one of his ability and capacity for work is certain to succeed in any venture he may elect.

To review completely the major activities of the Council in which Dr. Gordon had a leading part would carry us far beyond our allotted space. We shall present here only a brief summary of his voluminous work so that, from the record, future Council members and others interested may adequately measure the immensity of constructive accomplishments achieved by its first secretary. His contribution stands out prominently as a mark at which his successors can aim. While many members of the profession have been conscious of the achievements of Dr. Gordon, it is highly probable that the real import of his pioneering work will be even better understood when studied in the light of recorded historical experience.

Following the reform movements of the United States Food and Drug Department fostered by the late Harvey S. Wiley, in cooperation with the Council on Pharmacy and Chemistry of the American Medical Association, many of the patent and proprietary medicine exploiters were so harassed that they stealthily moved over into the field of the less vigilant dental profession, where, for twenty or more years, they carried on their exploitations unmolested. During this time, conditions became so deplorable that, in 1927, the American Dental Association established its Bureau of Chemistry, and was fortunate in its selection of Dr. Samuel M. Gordon as chemist of the Bureau. Because of his experience with the Council on Pharmacy and Chemistry of the American Medical Association, Dr. Gordon was unusually well fitted for the position. His article, "The American Dental Association Bureau of Chemistry and the Profession," published in THE JOURNAL in May 1929, will convince any one of the broad understanding that Dr. Gordon already had of the responsibilities of his position. It also affords a contrast of conditions at that time with those of the present, making the notable progress in this field very evident.

A SUMMARY OF DR. GORDON'S ACHIEVEMENTS AS SECRETARY OF THE COUNCIL ON DENTAL THERAPEUTICS

During his investigation of products and the editing of a bimonthly bulletin, for eight years, Dr. Gordon investigated

more than two thousand dental products, either partially or completely.

He compiled eight large volumes giving the detailed reports of the many products investigated and found to be either acceptable or not acceptable. This alone was a stupendous piece of work.

He answered hundreds of letters of inquiry relative to products that had not been investigated or reported through the Council's space in THE JOURNAL. Every one of these letters, stating the problems of individual dentists, was painstakingly answered.

He carried the major part of editing and reediting "Accepted Dental Remedies," of which approximately 15,000 copies have been sold.

He prepared an interesting educational exhibit that was shown at many state meetings and at the Annual Session of the American Dental Association. Hundreds of dentists will recall the discussion and clarification of some of their problems by Dr. Gordon while he was in charge of these exhibits.

He cultivated a better understanding, which developed into closer cooperation, between the Council and honest-intentioned manufacturers. Because of this, the Council received recognition and greater cooperation from the law-enforcing agencies of the Food and Drug Department and the Federal Trade Commission. These agencies, because of the authentic information provided by Dr. Gordon, cooperated most effectively in dealing with some of the fraudulent and worthless nostrums sold in the name of dentistry.

He undertook the standardization of abrasives used in toothpastes and tooth powders so that, at the present time, certain manufacturers are preparing acceptable polishing agents.

He convinced certain dentifrice manufacturers of the advisability of removing toxic and other injurious substances from their products.

He paved the way for a more respectable type of advertising of dentifrices in general, to the extent that, from present indications, the most embarrassing and obnoxious types of dental advertisements are likely to disappear and a better feeling will exist between the Council and the reputable manufacturers of dentifrices.

With all this work to his credit, Dr. Gordon has now resigned from the Council. His efforts and accomplishments deserve the approbation and commendation of the entire profession.

On recommendation of the Council on Dental Therapeutics, the Board of Trustees has appointed Harold L. Hansen, M.S., Ph.D., to succeed Dr. Gordon. Dr. Hansen has both the training and the necessary experience to engage in this work. He has contributed to various scientific publications, such as the *Journal of the American Chemical Society* and the *Journal of Pharmacology and Experimental Therapeutics,* as well as THE JOURNAL. Since the first of December 1937, at which time Dr. Gordon resigned, the work of the Council has been practically at a standstill. With Dr. Hansen's appointment as secretary of the Council and director of the Bureau of Chemistry, work will again be resumed.

ASSOCIATION ACTIVITIES

COMMITTEE ON LEGISLATION

MAIL ORDER DENTURES

A MAJOR effort of the Committee on Legislation is directed toward the outlawing of the improper practice of selling dentures, or rather what is claimed to be a denture, by mail. This committee has corresponded with state dental examining boards in those states harboring mail order offenders, the Federal Trade Commission and the U. S. Post Office Department in an attempt to stop a bushwhacking practice that depends on the gullibility of the public for its easy profits.

Complaints from dentists and laymen from nearly every state have flooded our mail, with generally an expression of bewilderment that a method of practice which is branded detrimental to public health and welfare and condemned by the American Dental Association, continues unchecked, although apparently in violation of state dental laws.

The Federal Trade Commission so far as its present authority permits, has taken action against several of these concerns, greatly modifying claims that originally appeared in all these advertisements. Following extensive investigations of these concerns, conducted by the U. S. Post Office Department, a hearing was set in Washington by Postal authorities on November 22, 1937, when charges of fraud were presented in the case of S. B. Heininger of Chicago, whose dental license was recently revoked by the Illinois Department of Registration and Education.

The January Journal of the A.D.A. published a brief account of this court hearing which resulted in a "Fraud" order being issued on February 21, by the U. S. Post Office Department, refusing use of the Mails to Dr. S. B. Heininger, Dr. S. B. Heininger, D.D.S., Dr. S. B. Heininger, Dentist, Dr. Heininger, and Sylvan Dental Laboratory, Chicago, Illinois. Appeal was granted and pending final action the Department is enjoined from enforcement of this order.

This action of the Government, if upheld, will have far reaching consequences in the protection of public health and welfare, as they may be affected by methods of dental practice and will effectively remove a very definite threat to the continued maintenance of the present high standards of dental teaching and practice.

A. B. PATTERSON, *Chairman,*
Committee on Legislation,
American Dental Association.
Joliet, Ill.

LEGISLATIVE CONTROL OF ADVERTISING

Legislative action on a bill giving the Federal Trade Commission broad powers over the advertising of foods, drugs, cosmetics and therapeutic devices was completed today, March 15, when the Senate approved a conference agreement on the Wheeler bill and sent it to the White House.

The Wheeler bill relates to so-called false advertising, which is defined as "advertising, other than labeling, which is misleading in a material respect." The

Federal Trade Commission is empowered under existing law to prevent "unfair methods of competition" and "unfair trade practices." This power is extended to embrace "unfair or deceptive acts or practices in commerce."

The bill empowers the trade commission to hold hearings, upon complaint, and issue "cease and desist" orders when it finds that any person, corporation or partnership is engaging in unfair or deceptive trade practices. After such orders become final, either by judicial approval or failure to appeal to the courts, a civil penalty of $5,000 is imposed for each violation. Procedure by injunction also is provided.

One provision of the bill makes it unlawful to disseminate or cause to be disseminated any false advertisement, and if the violation is committed with intent to defraud, or the commodity advertised is injurious to health, the offender is subject to a fine of not more than $5,000 and a prison sentence of not more than a year.

No publisher, radio broadcaster or advertising agency may be held liable under the latter section unless he refuses on request of the Commission to furnish the name and address of the advertiser.

Senator Royal S. Copeland (D., N. Y.), sponsor of the ill-fated food and drug bill, was the only senator who objected to the Wheeler measure.—*Chicago Tribune Press Service.*

RECENT COURT DECISIONS

ACCIDENT INSURANCE: BURNS SUSTAINED BY DENTIST AS RESULT OF PROLONGED USE OF ROENTGEN RAYS

The plaintiff, a dentist, was issued three insurance policies by the defendant company, under which he was insured against loss resulting from bodily injuries effected through accidental means. While the policies were in force, ulcers appeared on the index fingers of both of the plaintiff's hands, resulting from the breaking down of the tissues of the fingers following a long and continued application of roentgen rays used in the treatment of his patient. Thereafter he was continuously disabled from performing one or more important daily duties pertaining to his profession. The insurer contended that the injuries were not effected through accidental means and refused to pay the benefits. The plaintiff thereupon brought suit and the jury returned a verdict in his favor. When the trial court denied the insurer's motion for a new trial, the company appealed to the Supreme Court of Errors of Connecticut.

The plaintiff, said the court, used the x-ray machine for the purpose of diagnosis in his profession and was skilled in its use. The evidence justified the jury in finding that the injury to the plaintiff's forefingers was due to exposure of these fingers to the roentgen rays a number of times, the cumulative effect of which was to cause the breaking down of the tissue and the appearance of the ulcers. The plaintiff did not intend to expose himself to the roentgen rays to such a degree as to produce injurious consequences. It was for the jury to determine whether the resulting injury was accidental in the sense of something unexpectedly taking place—not according to the usual course of things—or whether the result was one such as usually follows from ordinary means voluntarily employed. The ulcerations certainly constituted a bodily injury and the exposure of the plaintiff's fingers was an accident, in the opinion of the court; it was "an untoward event or condition not expected." The evidence justified the jury in finding further that the amount of tolerance to exposure to roentgen rays without injurious effect varies with the individual. Until the breaking down of the tissues appeared, it was not perceptible that there had been an overexposure or too frequent exposures. The unexpected and unanticipated event in this case, the court said, was not the exposure to the roentgen rays but the overdose of it producing the ulcers on the plaintiff's fingers.

The Supreme Court of Errors, therefore, held that the trial court did not err in denying

the insurance company's motion for a new trial. King v. Travelers Ins. Co. (Conn.). 192 A 311. Medicolegal Abstracts, *J.A.M.A.*, 110:536, February 12, 1938.

DENTAL PRACTICE ACTS: PROHIBITION ON ADVERTISING OF PRICES CONSTITUTIONAL

The plaintiff in this case had been practicing dentistry in Richmond, Virginia, since 1930. He had advertised extensively, through the newspapers, the prices and terms charged for his professional services, had offered free dental examinations and had guaranteed satisfactory dental work. Such advertisements, from time to time, were illustrated with photographic cuts of teeth or bridge work. In 1936 the general assembly amended the dental practice act by empowering the state board of dental examiners to revoke or suspend a license of any dentist who advertised his services in a manner proscribed in detail in the amendatory act. The plaintiff thereupon sought to enjoin the state board of dental examiners from the threatened revocation or suspension of his license for engaging in advertising of the type prohibited by the act. The trial court dismissed the bill of complaint and the plaintiff appealed to the Supreme Court of Appeals of Virginia.

The contention that the act violated the federal constitution, the court said, was disposed of by the United States Supreme Court in Semler v. Oregon State Board, 294 U. S. 608, 55 S Ct. 570, a case involving the dental practice act of Oregon, which contained provisions similar to those in the Virginia act. In that case it was held that the restrictions on advertising did not constitute an arbitrary interference with the liberty and property guaranteed by the federal constitution but was a reasonable exercise of the protective police power of the state. The plaintiff in the present case did not question the right of the state, under its police power, reasonably to regulate the practice of dentistry, but strenuously contended that such legislation must bear a fair relation to the public health, morals, safety or welfare of the people, and that so long as there is nothing untruthful in the advertising matter the public welfare is not adversely affected thereby. But, the court remarked, the exercise of police power is not limited to the prohibition of acts which are malum in se. The legislature may pass laws intended to prevent fraud even though the act prohibited is itself harmless. In recent years laws of the character here attacked, regulating the practice of dentistry, have been passed by a majority of the states. Thirty states, the court pointed out, prohibit the advertising of prices, twenty-eight prohibit the advertising of display signs carrying cuts or illustrations of teeth, twenty-one prohibit the advertising of free dental services, and nineteen outlaw the advertising of guaranteed dental work. The constitutionality of these laws has been attacked in numerous instances and in a majority of cases the statutes have been upheld. With one accord these court decisions point out that while the advertising of prices, terms and display of teeth, and so on, may not be harmful in itself, statutes of this character are aimed at the unscrupulous practitioner and quack, who usually resorts to such "high-powered salesmanship" methods to lure the ignorant and unsuspecting public to his office; that it is for the legislature and not the courts to say whether or not it is necessary, in order to close the door to such an unscrupulous practitioner, and to prevent the perpetration of fraud and deception on his patients, that all advertisements except as permitted in the statute be prohibited. With this reasoning, the court in the present case expressed itself as in thorough accord.

It is a matter of common knowledge, the court said, that many laws intended to protect the public put restraints on the acts and conduct of men of honest motives and purposes. If the present statute burdens an honest business, the answer is that it burdens it "only that under its forms dishonest business may not be done." The statute does not destroy the plaintiff's right to practice his profession. It simply requires him, and every other dentist in the state, to conform to the ethics of the profession. There was no merit in the plaintiff's contention, the court said, that the statute was class legislation because it applied only to dentists and not to medical practitioners generally. Neither was there any merit in the contention that the statute violated the due process clause of the Virginia constitution "because it provides for the trial of a so-called unethical dentist before a board composed exclusively of the so-called ethical dentists."

The argument was that, in a proceeding to

revoke or suspend the plaintiff's license, the state board of dental examiners was not a fair and impartial tribunal because it favored the enforcement of the statute as written by the general assembly. The mere statement of this proposition shows it to be unsound. How can it be said, the court questioned, that the willingness of a tribunal to enforce the law as written renders the tribunal incompetent to conduct a trial? It might as well be argued that a judge of any court is incompetent to try a case because he favors the enforcement of the law as written.

The decree of the trial court, dismissing the complaint, was therefore affirmed.—Goe v. Gifford et al. (Va.) 191 S. E. 783. Medicolegal Abstracts, *J.A.M.A.*, 110:535, February 12, 1938.

RESEARCH COMMISSION

HEMOSTATIC EFFECTS OF ADMINISTRATION OF CALCIUM, VIOSTEROL, STYPTYSATE, AND CEANOTHYN BY MOUTH*

By M. L. Tainter, M.D., and A. H. Throndson, D.D.S., San Francisco, Calif.

IN many dental procedures, bleeding has to be especially combated because it obscures the field, makes the operative procedure more difficult and is, of course, deleterious to the patient. There is, therefore, a constant need for therapeutic agents which will accelerate the coagulation of blood, so that bleeding will be diminished to a point where it is no longer troublesome. We are not referring here to the pathologic condition of hemophilia, since this condition is rarely, if ever, encountered in ordinary practice. But certain, otherwise normal, persons have a bleeding time of from ten to fifteen minutes without any other serious deviation from normality in the blood-clotting mechanism. These cases are the source of the major difficulties in hemorrhage in dental practice.

The normal coagulation mechanism involves a combination of reactions between tissue or blood ferments, the protein fibrinogen produced by the liver and calcium. These various elements in the blood are seldom seriously deficient, even in patients who bleed too freely. These patients are, therefore, essentially normal persons whose blood clots by the normal mechanism, but too slowly. Attempts to hasten the coagulation process have been numerous, and the reports on them have generally been characterized by great optimism on the part of the proponents of a particular method or drug. Too many articles have been written on the results in half a dozen coagulation time measurements, wherein the writer has contented himself with comparing the times observed in single control observations with subsequent times observed after a drug was administered. It is thoroughly established that the coagulation time, when measured by ordinary clinical methods, is somewhat variable, and therefore it is to be expected that, about half the time, any two successive readings may show a

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decreased time, whether or not any therapeutic agent is used. Therefore, conclusions as to the effect of administration of a drug on the rate of coagulation, without first firmly establishing the normal time to be expected and its range of variability, rest on a very insecure and unreliable foundation. The literature is almost entirely lacking in studies in which the normal coagulation times of individuals have been determined repeatedly until the average values and their statistical variability have been established. Without this, any apparent subsequent change in the observed time cannot be reliably interpreted.

Therefore, the present study has been directed at repeated measurement of the coagulation time of a group of individuals until the average values of the times observed have been established with a high degree of certainty. Then a drug has been administered over a period of days or weeks, and the coagulation time under the influence of this medication has been similarly established by repeated measurements. These tests have been controlled further by subsequently observing the subject for a similar period without medication, in order to have a second control period for comparison with the period of medication. By carrying on the observations in each period for a sufficient number of days, and by making a sufficient number of observations to permit reliable averages to be calculated, the results obtained by this method afford information not obtainable by the more usual method of conducting coagulation studies. Our method also shows the effect of prolonged administration of the drugs in question, which has been almost entirely neglected in the past. The other common method, that of comparing a single control coagulation time before medication with that after medication, can be so affected by the time of day, the diet, variations in activity and other conditions not completely understood that the results can seldom be accepted as convincing.

In this study, we are limiting the report to the effects of administration of calcium, viosterol, styptysate and ceanothyn by mouth, since the practicing dentist is only to a limited extent interested in hemostatic measures which require injection of a drug. In a subsequent paper, we shall discuss results with other hemostatics, primarily derived from, or associated with, animal tissues, such as tissue extracts and related materials.

METHODS

The coagulation times were measured by the capillary tube method, since this is the most common clinical method for determining the coagulation time, or for predicting a possible hemorrhagic tendency. Seven subjects were used in all, in a total of fifteen complete experiments, to determine the effects of four different drugs. A total of 1,099 coagulation time measurements were made in this series. The procedure was as follows: The lobe of the ear was pricked with a mechanical lancet, adjusted by a guard to give constant depth of penetration. The capillary tube was filled immediately from the drop of blood, and held in a fold of the palm of the hand to maintain a fairly constant temperature. Every ten to fifteen seconds, a short piece of the capillary tube was broken off, and the coagulation time taken as that when a filament of fibrin strung out between the two pieces of tubing. The time was measured in seconds from the first instant a drop of blood appeared on the ear to the observed time of clotting. Each subject made observations on his own clotting time, taking blood from the ears alternately, usually twice a day, for about two weeks. The coagulation times were always taken at the same time of day and with a constant relationship to meals and other activities and were so arranged as to be taken at the time of the supposed maximum action of the drug. This procedure was then continued for a further two-week period, during which the drug in question was taken. This

period of medication was followed by a second control period of similar duration to that of the first.

The average coagulation times for each period were calculated and the standard deviation of the mean or average (SD_m) derived by the usual formulas. Comparison of the control with the medication periods was made by calculating the standard deviation of the difference between the means ($SD_{diff.\ means}$). An estimate of the reliability of the observed difference was then obtained by calculating the critical ratio (CR), which is the ratio of the difference between the two means to the $SD_{diff.\ means}$, and the probability of significance of this secured from standard probability tables. As it requires a CR of 2.0 or more to give a probability of 20 to 1 or better that the result may not be due to chance, it is believed that any CR less than 2.0 is not proof of a probably true difference between the two series. It must be emphasized at this point that when the CR is greater than 2.0, the differences are not necessarily biologically or clinically significant. The fact is simply established that the odds are very great against chance alone being responsible for a difference of the magnitude observed. Then, if it is accepted that the difference between the average or mean results was not a chance variation, it is in order to inquire whether this difference is of sufficient magnitude to be of any importance in the practical application of the drug in question.

For example, it might be perfectly feasible, by performing a sufficiently large number of experiments, to show that some given drug would change an average coagulation time of 200 seconds to 195 seconds, and it could then be predicted with a high degree of certainty that, if the medication were repeated over and over again, this would almost always be the average result. However, such a point having been proved, the interpretation would still be quite obvious that, for all practical purposes, the medication in question was of no particular value, because, if it could only produce a shortening of coagulation time of five seconds out of a total time of 200 seconds, it would have so little influence under normal conditions as to be practically useless. Therefore, the statistical treatment of the data in this paper does not, in itself, prove that the hemostatic agents in question are or are not valuable drugs to use. It merely allows a determination with certainty as to whether the data are reliable enough to use the averages as a basis for conclusions. The results may now be described according to the agents tested.

CALCIUM

Calcium is known to play an indispensable rôle in the coagulation of blood. It is by no means established, however, that a prolonged coagulation time is frequently associated with an inadequate blood calcium content. In the years 1893 to 1905, Wright and his co-workers advocated the use of calcium by mouth for a wide variety of clinical conditions, including the control of hemorrhage and the acceleration of the coagulation process. There is considerable evidence that injection of calcium can shorten the coagulation time, but there is less certainty that the same is true of oral administration.

In spite of negative observations made under reliable conditions by Addis,[1] Dale and Laidlaw[2] and Loewenstein and Politzer[3] reports appear from time to time of the effective action of calcium when taken by mouth, and textbooks and writers of clinical articles advocate the use of calcium by mouth preoperatively to diminish bleeding. Examples of observation of positive results from oral administration of calcium are those of Colemann[4] and Hinman and Sladen.[5] More recent advices to use calcium chloride or calcium lactate in this way are those of Thibault[6] and Fitzgerald.[7] There is some evidence, although not very convincing, that calcium gluconate is better

absorbed than either of the other two salts, and therefore it might have a better prospect of being effective orally. Further evidence that improved absorption of calcium might be desirable is seen in the results of Matusevich,[8] who found that the addition of ammonium chloride, which is known to increase absorption of calcium, shortened the coagulation time more than addition of calcium chloride alone.

In order to fix firmly the normal value and its natural range of variability, in none of these positive studies was the coagulation time measured over a long period before medication was started. By the use of a more arduous technic, our study affords adequate control observations, which have hitherto been lacking. It also shows any protracted or slowly developing effects, which might be missed in observations for only a few days.

In our tests with calcium, the four subjects took control observations for from thirty-two to forty-five days, divided into control periods before and after medication. Calcium gluconate was administered for from fourteen to twenty days, during which time the coagulation time observations were continued. The dosage of calcium gluconate was 13.5 gm. a day, taken in the form of chocolate-coated tablets with each meal.*

Figure 1 shows that the greatest decrease in the average coagulation time was thirty-four seconds, in one subject. In another subject, the average time was increased by fifteen seconds. In the two others, the changes were so slight as to be of no significance. If the two control periods are considered together for comparison with the period of medication, as shown in accompanying table, in only one subject was there enough change to have a CR over 2; that is, beyond the range of chance fluctuation. The average change in coagulation time produced by the administration of calcium for all four subjects was only a decrease of seven seconds out of an average of 174 seconds. It is therefore quite certain that administration of calcium in these large therapeutic doses, for periods as long as twenty days, cannot be relied on to reduce the coagulation time by any significant amount. The small decrease observed in one subject may be much more reasonably ascribed to some minor intercurrent infection, or to a variation in daily activity or to diet, etc., than to any specific effect of the drug, inasmuch as no similar effects were seen in the other three subjects.

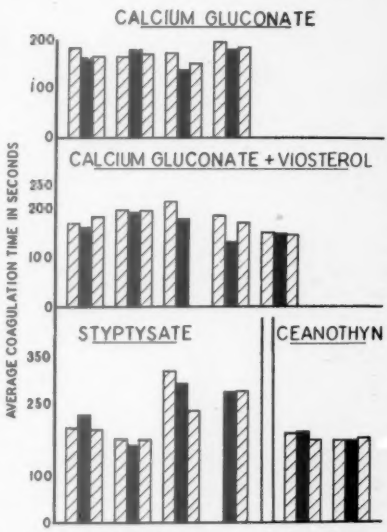

Fig. 1.—Variation in coagulation time.

CALCIUM GLUCONATE AND VIOSTEROL

In view of the fact that Matusevich[8] observed a shortening of coagulation time with calcium when absorption was increased by the use of ammonium chloride, an attempt was made to obtain the same result by a more normal means of increasing calcium absorption; that is, by the administration of vitamin D. It is now well

*We are indebted to E. R. Squibb & Co. for the calcium gluconate and viosterol used in this study.

AVERAGE COAGULATION TIMES IN CONTROL PERIODS AS COMPARED WITH PERIOD OF MEDICATION*

Subject	Control Period				Medication Period					
	Days No.	Observations No.	Coagulation Time Sec.	SD mean Sec.	Days No.	Observations No.	Coagulation Time Sec.	SD mean Sec.	SD diff. means Sec.	Critical Ratio
					Calcium gluconate, 13.5 gm. a day					
Tn	32	64	170	3.8	19	38	182	6.0	7.1	1.70
Tn	35	70	176	3.8	17	33	164	14.7	15.2	0.79
Er	45	45	190	2.1	14	14	183	4.0	4.5	1.60
Ci	34	34	161	5.2	20	20	140	4.7	7.0	3.00
Average coagulation time			174				167			
					Calcium gluconate, 13.5 gm. and viosterol 1 cc. a day					
Tn	29	58	197	3.7	19	38	194	5.1	6.3	0.47
Tn	29	58	178	3.3	15	29	162	2.9	4.4	3.60
Bd	14	28	215	3.9	12	24	180	8.2	9.1	3.80
Er	45	45	183	2.9	14	14	134	8.0	8.5	5.80
Ci	30	30	151	4.4	14	14	150	6.0	7.4	0.14
Average coagulation time			185				164			
					Styptysate, 9 tablets per day					
Tr	30	60	171	4.4	15	30	160	5.8	7.3	1.50
Br	20	39	274	9.6	11	22	290	13.0	16.2	0.99
Tn	31	59	195	2.2	14	28	223	8.4	8.7	3.20
Bs	9	12	275	8.4	24	27	273	7.8	11.5	0.17
Average coagulation time			229				237			
					Ceanothyn, 30 cc. a day					
Tn	31	61	184	6.4	14	28	190	11.9	13.5	0.44
Tr	30	60	177	3.6	10	17	173	5.3	6.4	0.63
Average coagulation time			181				182			

* $SD_{diff.\ means}$ is the standard deviation of the difference between the mean or average of the control period and the period of medication. Critical ratio is the difference between these two means divided by the $SD_{diff.\ means}$.

established that vitamin D largely controls the normal calcium absorption from the gastrointestinal tract, and that administration of increased amounts of this vitamin brings about an increase in calcium absorption. Apparently, however, the appli-

cation of this fact to shortening of coagulation time clinically has received little attention. Selye,[9] in 1928, gave massive, and probably toxic, doses of irradiated ergosterol to rats and observed a decrease in the coagulation time. Similar observations were made by Phillips, Robertson, Carson and Irwin in 1931.[10] The only similar clinical report we have seen is that of Brougher,[11] who, in 1930, reported that administration of cod-liver oil or viosterol in therapeutic doses reduced the coagulation time by from one-half to two-thirds. However, in his experiments, there was apparently only a single control observation on each subject before medication, and this lack of adequate control leaves the validity of the observations in question.

In our study, calcium gluconate in a dose of 13.5 gm. was given as before, and with this there was taken daily a dose of 1 cc. of viosterol. This has a vitamin D potency of 10,000 U.S.P. vitamin D units per gram, so that our subjects were getting about three times the usual maximum therapeutic dose. The control periods were maintained before and after the medication, as before. The accompanying graph shows that, in the first, third and fourth subjects, there were decreases in the average coagulation time, but only in the third and fourth subjects were they of any appreciable magnitude. The greatest effect observed was a drop from 187 seconds in the precontrol period to 134 seconds under medication, followed by recovery to 172 seconds during the second control period. When the control periods are taken together for each subject, the results, as shown in the accompanying table, were in at least three of the subjects, large enough in comparison to the variability of the data to be statistically reliable. That is, they had a CR over 2, and so there was little chance that the decreases in average coagulation times observed were due to chance fluctuations. However, in these three subjects, the average coagulation time in subject Tn was decreased only sixteen seconds; in Bd, thirty-five seconds, and in Er, forty-nine seconds.

Hence these results, even though they might be reliable as far as they were reproduceable, still are not of such magnitude as to be of any real clinical value, except perhaps in subject Er. The average of the whole series showed a decrease of only twenty-one seconds, or about 11 per cent, and a change of this magnitude is not great enough to be of any real clinical value. Therefore, it is concluded from these data that, although there is evidence that massive doses of calcium and viosterol together may decrease the coagulation time in about one-half the subjects, the changes that can be produced by this means are too small to be of any practical use. Such a result is in accord with present concepts of the stability of the blood calcium, since it is generally recognized that alterations in the amount of available calcium in the blood are produced only with great difficulty.

STYPTYSATE

Styptysate is made by an uncertain method from Capsella bursa-pastoris, or "shepherd's purse." It came into prominence in Germany during the War, for the control of uterine bleeding, as a substitute for ergot. From this use, styptysate came to be used by some for control of hemorrhage from other regions, despite a lack of adequate consideration of the differences in the mechanisms involved in bleeding from the uterus and in ordinary vascular injuries. Styptysate is even now the subject of occasional favorable reports,[12] and it is frequently referred to in dental texts for use before operations. This compound has been the subject of adverse reports by both the Council on Pharmacy and Chemistry of the American Medical Association[13] and the Council on Dental Therapeutics of the American Dental Association.[14] The conclusions in these reports were that no evidence was available that styptysate had any action

on the coagulation time in ordinary bleeding.

In our study, styptysate was taken by four subjects, in a daily dose of nine tablets a day, or three with each meal, a dose which is as large as, or larger than, that clinically recommended. The accompanying graph shows that, in the second subject, there was a very slight decrease in coagulation time; and in the third subject, a decrease when compared with the precontrol period, but an increase over the postcontrol period. In the fourth subject, there was no change at all; whereas, in the first subject, there was a rather definite delay of coagulation. When the control periods are averaged, as shown in the table, it is seen that the only change of statistical reliability was the increase in average coagulation time seen in subject Tn, and this was an increase of twenty-eight seconds. The average result for the entire series was an increase in the average time of eight seconds. There can be no question, therefore, that, in this study, where an adequate number of control data are available for comparison, styptysate completely failed to decrease the coagulation time. Therefore, it has no therapeutic justification for use as a hemostatic.

CEANOTHYN

Ceanothyn is said by the manufacturer to be an extract of the alkaloids of Ceanothus Americanus L., or "Jersey tea." It is said to have been recommended originally, in 1836, in the *Boston Medical and Surgical Journal,*[15] and also to have been referred to by Hammond as a hemostatic in the *Georgia Eclectic Medical Journal,* in 1879.[16] Reports bearing on the chemistry and pharmacology of these alkaloids have been recently published.[17, 18, 19] The claims made were that administration of ceanothyn to experimental animals or patients by mouth, or by injection, shortens the coagulation time by as much as one-half the original. As none of these studies were adequately controlled, the validity of the conclusions may be questioned. Moreover, Gibbs, in a critical study, adequately controlled, showed that even as much as 80 cc. of ceanothyn taken by mouth did not reduce the coagulation time.[20] However, one article has been published in which the coagulation time was measured in 225 patients, with a decrease in the time required for clotting in every single instance.[21] Apparently, the author made single control observations, followed by the administration of 15 or 30 cc. of ceanothyn by mouth, and then, at the end of about one hour, took a second coagulation time measurement. The average decrease was about 22 per cent. A decrease after medication in every single instance in a series of 225 patients raises a serious question as to whether there was some systematic error in the method, or in the treatment which the patients were receiving simultaneously. Other writers also occasionally advocate the use of ceanothyn before operations and apparently have some confidence in its efficacy.[22] Ceanothyn has been reported on by the Council on Pharmacy and Chemistry of the American Medical Association, with rejection of claims for effects on the coagulation process.[23]

In our studies, adequate controls were established as previously described, so that the defect in some of the previous positive reports would not be present. Only two subjects were used because the result came out so convincingly negative that it did not seem worth while to extend the series further. As shown in the graph and table, the subjects had control observations for a total of one month each and periods of medication of ten and fourteen days, respectively, during which time they took 30 cc. of ceanothyn daily. In one patient, the average coagulation time was increased by six seconds; in another, it was decreased by four seconds. It is apparent that no significant change in the coagulation time was produced by the administration of maximum doses of this product.

COMMENT

It is generally conceded by the critical workers in the field of hemostatics that the use of these materials by mouth has no real effect on the speed of the coagulation process. Our results, which supply, for the first time, measurements made enough times that a reliable average figure could be obtained, confirm this sound clinical opinion. Therefore, the results of single measurements made by the more reliable workers in the past, and the repeated measurements made by us on the protracted actions of the drugs, are in essential agreement; namely, that administration of calcium, viosterol, styptysate and ceanothyn by mouth does not reduce the coagulation time of normal patients by an amount great enough to be of any clinical value. There would, therefore, seem to be little reason for the clinician to continue the use of these materials.

Out of a desire to do everything possible for the patient in difficult cases of bleeding undoubtedly arises the uncritical but hopeful use of these drugs. However, it is believed that, although the motives may be above question, the result of using these drugs cannot but be disadvantageous to the patient. The surgeon who relies on such ineffective measures to control bleeding is apt to disregard or to slight other more effective measures; so that the result of relying on these valueless drugs is to run the danger of depriving the patient of more adequate means to prevent the hemorrhage or to control it. Therefore, we believe that the use of these alleged hemostatic products is irrational, unscientific and thoroughly unjustifiable in clinical practice.

SUMMARY AND CONCLUSIONS

1. The coagulation time of healthy human subjects was measured once or twice daily for about six weeks under constant conditions. The first and last two weeks of this period were taken as control periods, and the average times observed were compared with the average of the middle two weeks period during which medication was administered. The values observed were averaged, and the averages statistically computed to demonstrate the degree of variability and the probability that the differences observed were true effects of the drugs or due to chance fluctuation.

2. Administration by mouth of calcium gluconate in daily doses of 13.5 gm. produced an average decrease in coagulation time in four subjects of only seven seconds, which was within the range of natural variability and was not sufficient to be of therapeutic value.

3. The same doses of calcium gluconate, with the addition of 1 cc. of viosterol U.S.P. daily, in five subjects decreased the average coagulation time for the whole series by twenty-one seconds, or 11 per cent. However, there was practically no change in two of the five subjects; and in the remainder, the changes were so small as to be clinically of little, if any, value.

4. In four subjects, nine tablets daily of styptysate failed to reduce the coagulation time, the average change for all four being an increase of eight seconds.

5. Administration of ceanothyn in a daily dose of 30 cc. to two subjects left the coagulation time completely unchanged.

6. The results of this study, in which unusual care was taken to establish satisfactory control values and their chance variability, show convincingly that even two weeks continuous administration of these alleged hemostatic agents fails to modify significantly the coagulation time of the blood when used by mouth in maximum therapeutic dosage. Therefore, there is no justification for their continued clinical use with the hope of shortening coagulation time or reducing bleeding.

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COMMITTEE ON NOMENCLATURE

The Report of the Committee on Nomenclature for 1937, containing all the terms recommended by the committee during the past twelve years, is available on application to the chairman, Dr. L. Pierce Anthony, c/o American Dental Association, 212 East Superior St., Chicago, Ill.

BUREAU OF PUBLIC RELATIONS

A.D.A. PUBLICITY PLAN

THE Bureau of Public Relations announces a forward step in assisting the nation-wide educational work of the American Dental Association and its component societies.

The long-established firm of Theodore R. Sills & Co., 14 E. Jackson Blvd., Chicago, has been retained to handle releases to newspapers, trade journals and national magazines on all phases of the Association's activities.

An immediate function of the public relations work will be to help swell the proportions of the National Dental Health Poster Contest and secure press interest in the various local contests in every community where there is participation.

The services of the firm are extended to everyone of the Association's state and component societies. Officers of the societies are invited to seek the assistance of the Sills organization at all times through the Bureau of Public Relations' office in the A.D.A. headquarters, 212 E. Superior St., Chicago.

"NEITHER SHALL THERE BE ANY MORE PAIN"*

By ROBERT M. LEGGETT, D.D.S., and JOHN W. LEGGETT, D.D.S., San Francisco, Calif.

FOREWORD

In preparing this dramatization, we have endeavored to make it as accurate as possible. We have done considerable reading for that purpose. We found one article of particular value in the *Dental Cosmos* of September 1935, entitled "Horace Wells" by Walter H. Jacobs, of New York City. One of the illustrations for this article was a reproduction of an advertisement of Professor Colton's lecture, taken from the *Hartford Courant* of December 10, 1844. At the first presentation of this playlet at San Jose, a cut was made of this advertisement and printed on the program. Any group planning to produce this skit would find it very helpful to look up this article and study it.

The playlet so far has been produced twice. The first performance was given at a meeting of the California State Dental Association at San Jose, in April 1936, by the dramatics department of the state college at San Jose.

It was also produced at the meeting of the Southern California State Dental Association in Los Angeles, in September 1937, by the Pasadena Players, an outstanding group of amateur Thespians.

Any organization planning to produce this dramatization would do well to put it in the hands of the dramatics department of a school or college, or a group of talented amateurs, such as the Pasadena Players. With a little coaching from a dentist on the details of the administration of the gas and the extraction of the tooth, such a group or class has proved to be very satisfactory.

The purpose in securing a copyright on this playlet is not to put any obstacles in the way of any dental society or legitimate public health or education organization that wishes to produce it, but to prevent its being used in any unethical way or by unsuitable persons or groups. It is the intention to make it available for any legitimate presentation without payment of any royalty for its use.

*Revelations 21:4.

"NEITHER SHALL THERE BE ANY MORE PAIN"

A dramatic sketch depicting the discovery of surgical anesthesia by Horace Wells. The title is selected from the quotation on the Wells Memorial Window in Center Church, Hartford, Conn.: "Neither shall there be any more pain; for the former things are passed away." Revelations 21:4.

Scene I

In the wings of Union Hall, Hartford, Conn., December 11, 1844.

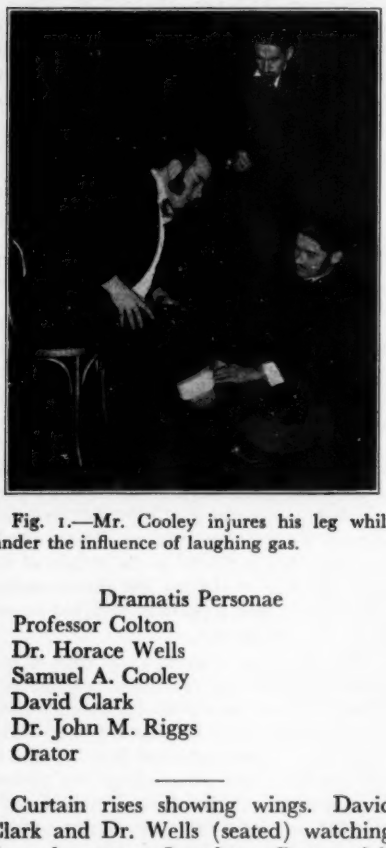


Fig. 1.—Mr. Cooley injures his leg while under the influence of laughing gas.

Dramatis Personae

Professor Colton
Dr. Horace Wells
Samuel A. Cooley
David Clark
Dr. John M. Riggs
Orator

Curtain rises showing wings. David Clark and Dr. Wells (seated) watching through scenery. Laughter off stage, followed by applause.

Colton (off stage): You have seen the amusing antics of your fellow citizens, as was promised. The gas has been administered only to gentlemen of the first respectability in order to make the entertainment in every respect a genteel affair. Fortunately, we have not required the services of the eight strong men engaged to protect those under the influence of the gas from injuring themselves or others.

For a full account of the effect produced upon some of the most distinguished men of Europe, see Hooper's Medical Dictionary under the head of Nitrogen.

Thanking you for your kind attention, this will conclude the evening's entertainment.

(Applause)

(During the above speech, Cooley limps in, dazed, and seats self in chair. Wells fans him with program, etc.)

Wells: Pray sit still a few minutes, Mr. Cooley, until the effects of the gas have passed off.

Cooley: Oh, I am quite recovered, Dr. Wells. A bit light headed, perhaps.

Wells: Your antics were most amusing.

Cooley: I grant it, sir. But you, too, you acted ridiculously—the crowd roared with laughter.

Wells (laughing): Yes, and dazed as I was, I did not miss the black looks my good wife directed toward me. I fear I shall hear from her on our way home.

Clark (teasingly): Quite beneath the dignity of our skilful dentist, Dr. Wells. (Laughs.)

Wells: Come now. I fear you are in league with my wife. No doubt such a thought was in her mind. But tell me, Sam (Mr. Cooley), are you not hurt? Really, you had a nasty fall.

Clark: Indeed *you* did, sir. You

crashed heavily against those benches. I am sure you must have barked your shins.

Wells: Yes! I fear *you* will be lame tomorrow.

Cooley: To speak the truth, my shins are smarting. (Rising.) Ah! and a bit lame, too.

Wells: Let us examine them. (Cooley pulls up pants' legs.)

Clark: Why, sirs, they are cut—and bleeding quite freely.

Wells: They will require some dressing. Permit me to bandage them for you. (Kneels and makes an examination, bandages legs with strips torn from handkerchiefs.)

Cooley: Do you think they require it?

Wells: I will bind them up a bit for you. Then when you return home, you should wash them well, apply some salve and bandage them. (Working as he talks.)

Cooley: Thank you, doctor. I am inclined to take your advice. I am surprised that they are so badly barked.

Wells: You must have seen stars when you hit them.

Cooley: I felt no pain at the time. I did not realize that I had bumped them.

Wells: You *felt no pain!*

Cooley: I give you my word, doctor. At the moment, I had not the slightest sensation of pain. But I must certainly admit that they are aching now.

Wells: It seems incredible.

Cooley: I have nothing to gain by deceiving you.

Wells: I realize that, Sam. I believe you. But it is little short of miraculous. David, I believe that a man, by taking that gas, could have a tooth extracted or a limb amputated and not feel the pain!

Clark: I should be inclined to think so, sir, since Mr. Cooley felt no pain on barking his shins. The shins are a tender spot.

Cooley: I quite agree. But, doctor, if I had knocked a tooth out when I fell, I do not believe I should have felt it.

(Enter Professor Colton with gas bag under arm.)

Wells: Professor Colton! Just the man I am most anxious to speak to. Would you answer a question?

Colton: Most willingly, dear doctor, if I can.

Wells: Mr. Cooley tells me he felt no pain whatever when he struck those benches and barked his shins. They are quite badly cut. The thought just flashed through my mind that by inhaling your gas a man might have a tooth extracted without pain. What do you think?

Fig. 2.—First extraction of a tooth under nitrous oxide anesthesia. Dr. Wells was the patient.

Colton: Frankly, I have given such a question no thought. I do not know.

Clark: Personally, I should think he might if Mr. Cooley did not feel his injuries.

Colton: I have been giving demonstrations of this gas for over a year, gentlemen, but the idea of using it for such a purpose had never occurred to me.

Wells: I am greatly inclined to try the experiment on myself, professor. I have a wisdom tooth of my own that has ached off and on for several days. If you would be so good as to provide some of the gas,

I would have Dr. Riggs extract it for me.

Cooley: I should like to be present at your experiment, doctor.

Wells: Gladly! If we can prevail upon the professor?

Colton: Surely. I have no objection to supplying you with a bag of the gas, but whether it will accomplish the purpose you wish, I cannot say.

Wells: But if Mr. Cooley did not feel

Fig. 3.—With fear and trembling, Dr. Wells' return to consciousness is awaited.

any pain when he fell, why cannot the gas be used for extracting teeth?

Colton: I do not know.

Wells: You are right, professor. None of us know, do we? We must find out! There is but one way. I will take the gas myself, have a tooth extracted and report on my experience.

Cooley: Well, doctor, since it is your tooth that is to be pulled, and not mine, I say by all means let us try the experiment, if only Mr. Colton will furnish the gas.

Colton: The gas will be at your disposal whenever you say.

Wells: Tomorrow then! I will walk by Dr. Riggs' on the way home and ask him if he will extract the tooth. Will you administer the gas, professor?

Colton: Gladly. Simply let me know the place and the hour, and I will come.

Cooley: And may I attend?

Wells: Certainly, if you wish.

Cooley: Then will you let me know the appointed hour and the place? I will have my messenger call by your office in the morning. He can also take the message to Professor Colton.

Colton: Let me have a few hours to prepare the gas.

Wells: Agreed! If Dr. Riggs is willing, it will be at his office or mine, and the hour, say sometime late in the morning?

Clark: Well enough, Mr. Cooley, if you wish to be present; as for me, I prefer not, lest there be some accident.

Wells: I will take the risk. I have long hoped some means might be found to lessen the pain of extracting a tooth. This may be an opportunity to serve mankind and my profession. (Curtain)

Scene II

Dr. Wells' Office

Time: The next morning.

Riggs: Horace, are you still determined to go through with this experiment?

Wells: Absolutely.

Riggs: Remember, you are a married man, with the responsibilities of a wife and a practice, and you can ill afford to risk your life in such a venture.

Wells: John, we went over all of that last night, and I am more eager than ever to test my theory. The good that will come to mankind outweighs a hundred fold any risk I am taking.

Riggs: But I should hate to be involved in anything that might cause injury, or even death, to you.

Wells: You are not. Your part in the procedure is merely to extract the tooth. Professor Colton will administer the gas, and I am assuming full responsibility for whatever may be the outcome.

Riggs: Still there is some danger.

Wells: None of those who have inhaled the gas have suffered any serious ill effects.

Riggs: But to administer it to the point of rendering you unconscious, as you propose—we are not sure of what that may do.

Wells: Our friend Cooley must have been practically unconscious last night. (Knock at the door.) That must be Professor Colton. We can ask him. (Admits Colton and Cooley.) Come in, gentlemen. We are all ready—if we can get friend Riggs' courage up to perform his part.

Riggs: Horace, you know that—

Wells: Yes, John, I am sorry. I know that your concern is only for my safety and not from any lack of courage on your part. Have you the gas ready, Professor Colton?

Colton: Yes, I have a bagful, which should prove ample.

Riggs: I would feel better if you could reassure me on one point, professor.

Colton: What is that?

Riggs: In your demonstration, has it ever happened that some one has inhaled this gas to the point where he was completely unconscious?

Colton: I cannot say positively. Some of them probably came near to that condition.

Riggs: But you are not certain.

Colton: No.

Wells: But no one has been harmed by the gas. Come, let us proceed. (Gets into chair.) I can hardly wait to learn whether my theories are correct.

Cooley: I hope they are. If so, I may even let you draw that miserable tooth that has been afflicting me.

Colton (to Wells): Are you ready?

Wells: Just a minute until I place this block between my jaws so that I will not clench my teeth when the gas takes effect. (To Riggs.) Are you ready with the forceps?

Riggs: Yes. (Wells adjusts block, nods his head to indicate that he is ready. Professor Colton adjusts bag.)

Colton (to Riggs and Cooley): Quiet now, please. (To Wells): Just breathe quietly and regularly. That's it. (After a few breaths, Wells starts to raise his arm. Cooley holds it gently for a minute, then lowers it, and it hangs limply at Wells' side. Colton nods to Dr. Riggs who steps to the chair with the forceps. Colton withdraws the bag of gas, Riggs extracts the tooth, steps back and displays it in the forceps. Colton is watching Wells.)

Riggs: Is he all right?

Colton: Absolutely. He is breathing quite normally and will be entirely recovered in a few minutes.

Cooley: He made no sign of having felt it. I feel better about that tooth of mine. (Wells moves, puts hand to mouth.)

Riggs: Oh, let me remove that block. (Takes block from mouth, pats Wells on shoulder.) Well, old friend, I am certainly relieved to see you recovering from the gas!

Wells: The tooth—is it out—did you pull it?

Riggs: Yes, indeed, Horace—here it is.

Wells: (Feels in mouth) It's gone, no doubt of that.

Colton: You did not know it was being extracted?

Wells: No.

Cooley: And you felt no pain?

Wells: I did not feel so much as the prick of a pin. A new era in tooth pulling has come. It is the greatest discovery ever made!

Cooley: It should certainly help your practice.

Wells: My practice! This is too great a thing to be the property of one man. I shall announce it to the world, for the benefit of all mankind.

(Curtain)

Scene III

Bushnell Park, Hartford, Conn., thirty years later.

Orator: We meet here to honor the memory of a great man. Had it been Wells' fate to live out his allotted span of three score years and ten, he would be here now to receive the tribute so justly due him. Like many another benefactor of mankind, he found the world unreceptive and unappreciative. Through an unfortunate slip in administering the gas, his first public demonstration was not completely successful, and he was denounced as an imposter. Wells himself wrote of the incident, "The gas bag was by mistake withdrawn much too soon, and he was but partially under its influence when the tooth was extracted." There arose a bitter controversy, in which his claims were denied, and others sought to be recognized as having discovered and announced the method of using anesthetics in surgery. Before the merits of the conflicting claims could be properly judged and the recognition due him be granted, he came to his untimely death, in 1848, at the age of 33.

"Truth is mighty and shall prevail." Impartial investigation has proved beyond a doubt that to Horace Wells belongs the honor of having given to the world the use of anesthesia in a surgical procedure.

So today, after thirty years, the people of the city of Hartford and of the State of Connecticut take pleasure in honoring one of the greatest benefactors of mankind by the erection of this enduring monument. On their behalf, I now present to the city of Hartford this statue of Dr. Horace Wells, the discoverer of anesthesia.

AN ORGANIZED EFFORT TO PROMOTE DENTISTRY FOR CHILDREN AND WHAT IT IS ACCOMPLISHING

By E. L. Pettibone, D.D.S., Cleveland, Ohio

IN the first major effort to teach preventive dentistry under the leadership of the late W. G. Ebersole and the National Mouth Hygiene Association, we discovered that we must begin with children in order to really teach mouth hygiene, and that we must begin inspection and care very early in order to save teeth.

The Marion School Experiment in Cleveland in 1909 demonstrated to the school boards of the world that it paid to teach mouth hygiene and that it cost only one-tenth as much to fill a child's teeth as it did to educate the child for a year. So we trained dentists to take care of the teeth of the children.

After Dr. Ebersole's death, the National Mouth Hygiene Association went out of existence.

In 1921, the Executive Secretary of the American Dental Association received a request from Thomas B. McCrum, of Kansas City, Mo., that an effort be made to organize the dentists interested in dentistry for children at the time of the Annual Session in Milwaukee. This request was turned over to me as chairman of the Section on Mouth Hygiene and Preventive Dentistry of the American Dental Association that year. A luncheon meeting was arranged and a general invitation

(Read before the Section on Children's Dentistry at the Seventy-Ninth Annual Session of the American Dental Association, Atlantic City, N. J., July 15, 1937.)

issued to all dentists interested in dentistry for children. About thirty dentists were present and the group decided to perfect an organization. A small group of dentists who limited their practice to children constituted the active members of this new organization. Because, at that time, there were in the whole country very few dentists working exclusively for children, the chances of success for such a society were very limited, for a man will not keep up interest in an organization in which he has no vote.

In 1927 at the time of the Annual A. D. A. Session in Detroit, another attempt was made to organize those dentists interested in dentistry for children.

This meeting was preceded by an effort to create interest in the movement and was called by and guided at its inception by some really inspired leaders. A tentative constitution had been drafted and submitted to interested men throughout the country, and changes and recommendations of these men were worked out before the organization meeting at which the proposed constitution was adopted. The name, suggested by the late F. Blaine Rhobotham, "The American Society for the Promotion of Dentistry for Children" was adopted.

The organization was founded with the idea that the general practitioner must be encouraged to do children's work and that the organization was *not* for specialists, but primarily for the general practitioner. Second, it was decided that the dues be nominal in order to encourage the general practitioner to enroll. Third, it was decided that the society set itself solidly behind the American Dental Association.

To the credit of its founders, it can be said that these original policies have been followed uninterruptedly to date. The growth of the society has been steadily toward greater service to the dentist and to dental groups who aim to further dentistry for children.

Dentistry for children has progressed markedly in the past decade, and most of the progress is easily traceable to the extensive efforts of this society. In 1926 everyone—dentists, colleges, societies and publications—seemingly took it for granted that dentistry for children was like dentistry for adults, only, perhaps, easier for some operators. In practice, most dentists found that it was not easier, and, unsuccessfully trying to cope with the management of children, found that their dental work for the child literally fell apart. They also found it most difficult to collect adequate fees, and, as a result, the most conscientious operators rendered half heartedly what service they knew how to render.

Previous to this start toward dental service for the children of America, there was practically nothing taught about pedodontia. Of the forty-six colleges in operation in 1926, only four made any attempt to give students any instruction in pedodontia. Now of the thirty-six colleges, fairly complete instruction is given in twenty-nine. Especially notable is the Indiana University School of Dentistry at Indianapolis, which has not only a college department of pedodontia, but a separate, adequate, excellently equipped children's operating room, complete in every possible detail. Most of this progress can be credited to the efforts of the college committee of this society. In the past year, in view of the fact that most of the colleges are giving instruction in pedodontia, this committee has made a survey of the state examining boards to ascertain how many were examining their candidates in this subject. A questionnaire was formulated, consisting of six questions, and sent to the secretary of every state board.

All the answers have not been received to date, but the replies which have been received are very encouraging. Several states which did not in the past examine candidates on the subject of pedodontia have taken measures to do so in the future. All the states except two have asked

for a set of the 140 questions on children's dentistry as compiled by the American Society for the Promotion of Dentistry for Children and the questions have been sent them. All of the boards agree that questions on pedodontia should be included in state examinations.

It is hoped that this survey will lead the various state boards to examine candidates in pedodontia, as well as lay the foundations for the adoption of a clinical examination, in order to ascertain the degree of proficiency in the instruction in pedodontia. Preventive dentistry is the important thing today, and its practice has to begin with very young children if dentistry is to change the old statistics showing from 70 to 99 per cent of school children with decayed teeth. A state board examination in children's dentistry will do much to further this program and change dental practice.

The foundation of the American Society for the Promotion of Dentistry for Children has been carefully built in the past ten years and this past year a countrywide effort has been made to build up the membership, which today is 453. This is quite a creditable membership for so young an organization, but it is the hope and objective of the officers that they may continue to make the society more and more attractive each year in order that more members of the American Dental Association may join the society and be inspired to give more study to the care of children.

The Review of Dentistry for Children, under the editorship of Samuel D. Harris, has been the guide and inspiration in building up the society, in adding to the interest of the membership and in promoting individual and community activity in dentistry for children.

In the past year, the society's Committee on Standards for School Dental Programs for Children has accomplished an outstanding work. Assisted and supported by the authoritative leaders of the dental, medical and teaching professions, they have made a most complete and comprehensive survey, with recommendations that:

1. The Bureau of Public Relations of the American Dental Association, the Committee on Dental Health Education of the American Dental Association and the American Society for the Promotion of Dentistry for Children cooperate periodically in publishing attainable standards for school dental service programs for children.

2. The boards of education, boards of health and dental societies collaborate in community dental service programs for children.

3. Community dental service programs for children be supervised by competent dentists.

4. Community service programs for children be limited to the underprivileged child and that emphasis be placed on preventive service.

5. Funds for dental service programs for the underprivileged children be secured from tax-supported agencies.

6. The American Dental Association, through the Bureau of Public Relations and the Committee on Dental Health Education, collaborate with the American Society for the Promotion of Dentistry for Children in designing charts and planning procedures for group dental inspection of children.

7. Examinations for determining dental needs of a group be conducted by the dentist, using mouth mirror and explorer* (Walker II Type).

8. Dental hygienists of recognized training in education, child psychology and public speaking be included in community dental service programs conducted under dental supervision.

9. The following materials and operative procedures be recommended for community dental service programs:

Silver amalgam alloy for posterior, deciduous and permanent teeth.

*Dental hygienists may make the examination when expedient and advisable.

Silicate cements for anterior permanent teeth.

Pulp treatment, but for anterior teeth only.

Zinc oxide and eugenol for pulp capping.

Copper and silver cements for linings, steps and treatments.

Copper amalgams for cervical cavities in posterior teeth.

10. Pits and fissures in deciduous and permanent teeth be filled.†

11. Supervisors of school dental service programs acquire the knowledge available in public health education and technics.‡

12. Operators employed in community dental service programs be well grounded in the latest methods of operative procedures in dentistry for children and in the management of children.

The bibliography committee, which has for its purpose the task of suggesting and recommending the best and most timely articles on all phases of dentistry for children, is also endeavoring to collect literature, data and suggested methods and the technics on all phases of operative, restorative, surgical and therapeutic branches of dentistry for children as practised by the leaders and the more experienced operators in the field.

This committee published in the *Review of Dentistry for Children* a column of abstracts on leading articles on pedodontia. Under the leadership of the chairman, Joseph H. Kauffman, the members are gathering bibliographic references as follows: Charles F. Deatherage: "Patient Education"; Stephen A. Garrett: "Modified Operative Procedures"; Benjamin Kletzky: "Management"; Verne Wilt: "The Problem of Growth." This work is most important because we can progress only through the study of the literature and the application thereof.

This committee has been and will continue to be a great help, not only to the individual dentist seeking knowledge, but also to those groups and study clubs devoted to the study of pedodontia. Some of these groups are composed of enthusiastic, sincere workers who are learning and helping others too. One group, the Cleveland unit, revived the old traveling clinic idea, and this has not only helped to create local interest, but has also helped other groups in other cities and states. We urge members to try to start a similar traveling clinic in their states. Dentistry for children will attract members to state meetings. This has been conclusively proved in several states. The interest of the state society program committee should be aroused.

In this paper, I have only touched on some of the most conspicuous accomplishments of this organized effort to reach *all* the children of this country with preventive dental care and worth while reparative dentistry.

The pioneering work of its leaders will be monuments in the progress of our profession. I urge all members to fall in line with this fine group of self-sacrificing men and women who are leading the way. In the name of the children of America, let every one give them his cooperation and support and strive to enlist his fellow practitioners in this fine work.

6503 Detroit Avenue.

†Pits and fissures are defined as defective points in enamel where sharp explorer sticks.

‡The Social Security Act makes provision for each state to establish courses of instruction in public health service for dentists.

MISSOURI DENTAL POSTER CONTEST

Leo F. Marre, chairman of the National Dental Health Poster Contest for Missouri, reports that practically every district in the state is going over the top in the contest. The St. Louis, Kansas City and Columbia schools got underway at the beginning of the second semester.

Copies of the following suggestions, prepared by Dr. Marre and his committee, were mailed to all school superintendents. The National Poster Committee has a quantity of these suggestions on hand and they will furnish them to all who need them.

NATIONAL DENTAL POSTER CONTEST

(St. Louis, Mo.)

List of suggestions as to compositional material

Diet

Milk: Fresh (vitamins* A, B, C, G).
Condensed. Mineral salts: Lime, or calcium; phosphates.

Vegetables: Fresh: Carrots (vitamins A, B, C, G).
Lettuce (vitamins A, B, C, G).
Cooked: Sweet potatoes (vitamin A).
Tomatoes (vitamins A, B, C, G).
And others.

Fruits: Oranges (vitamins A, B, C, G).
Lemons.
Limes.
Grapefruit.
Apples.

Cereals: Warm cereals (vitamins A, B, G; mineral salts).
Bread, whole wheat (vitamins A, B, G; mineral salts).
Milk.
Orange juice (vitamins A, B, C, G).
Vitamin B for promotion of appetite and food absorption.

Carbohydrates: Negative effects, overindulgence and improper timing of eating. (Eat sweets after meals.)
Starchy foods for body fuel; satisfy taste for sweets with fruit dry or fresh.

Neglect

Cleanliness: Toothbrush.
Salt, soda, brush.
Mouth wash solutions.

Fibrous food: Celery.
Salads.
Apples, unpealed.
Raw fruits and vegetables.
Value of proper chewing.

Clinical
What the x-ray shows us.

*Vitamin D was omitted from the list because it was the intention to deal with vitamins found chiefly in foods common to the daily diet. Only the high schools and vocational schools are to be permitted to use the suggestions involving the vitamins.

Hidden conditions responsible for:
Arthritis.
Rheumatism.
Neuritis.
Eye infections.
Effects on hearing.
First permanent molar: Its effect on mouth beauty; a key to straight teeth.
Your Appearance: Crooked teeth; effect on beauty; on efficiency.
Missing teeth.
Lost teeth (detract from beauty).
Effects on profile.
The abscessed tooth and swollen jaw.
Personal comfort:
Efficiency in your work.
Attendance at school.
Pain and discomfort.
(The unhealthy mouth infects the food, produces conditions conducive to children's diseases.)
Diphtheria.
Scarlet fever.
Septic sore throat.
Measles.
Tonsillitis.
Prevention: Effects of neglect of the baby teeth. Value of inspection. Habit formation. Bad habit prevention.
Bad habits: Thumb sucking, lip sucking, mouth breathing, etc.
Rules for dental health.
1. Right diet or food.
2. Exercise (proper chewing).
3. Home care.
4. Regular inspection.

Other Suggestions:

1. Animation posters of toothbrush, sick tooth and healthy tooth making friends or greeting each other.
2. Children making friends with animated characters such as fruit, box of cereal, vegetables, etc.

NATIONAL DENTAL HEALTH POSTER CONTEST

DENTAL EDUCATION SPONSORED BY THE MT. BAKER DISTRICT DENTAL SOCIETY IN WHATCOM, SKAGIT AND SAN JUAN COUNTIES, WASHINGTON

THE Mt. Baker District Dental Society, which is composed of the members of the American Dental Association in Whatcom, Skagit and San Juan Counties, Washington, are working along the lines of the American Dental Association's slogan "Dental Health for American Youth." We will follow the rules for the Poster Contest in the schools of the cities and rural districts.

For the past twelve years, the Mt. Baker Society has carried on a very extensive educational program regarding dental health. Each year, with the cooperation of the preschool parent-teacher associations, they examine the preschool

children, particularly those about to enter school for the first time in September. Talks on dental health and preventive dentistry are then presented to parent-teacher association groups, service clubs, teachers' clubs and other interested audiences.

Several times during this period, they have been requested to examine the teeth of grade school children. This service was always rendered when requested.

This year in Bellingham, Whatcom County, the students are going to their own dentists for an examination, and the results of such examinations are relayed to the physical director of the school. Much good is expected to come from these examinations since the younger children are usually taken to the dental office by parents, and thus the dentist has an opportunity to spread health information.

The first week of May, Child Health Week, has been the grand finale of the work done during the year. This has been observed in many ways: poster contests, essay contests, dental health exhibits, showing of health films in theaters, window exhibits, radio talks and newspaper publicity.

This persistent educational work has produced a noticeable improvement in the condition of the children's teeth. Young mothers are more and more taking their children from 2 to 5 years of age for dental examinations. The dentists are finding fewer cavities, and what cavities they do find are not so extensive that repair work cannot be done. They find far fewer abscessed teeth. They find fewer first permanent molars to be extracted, and more mothers now know that the sixth tooth back is not a "baby" tooth and that it must have attention early if at all. Adults have been educated to the fact that periodical examination of their own teeth is the only sure method of securing oral health.

J. Ward Finley, *Chairman,*
Health Committee,
605 Herald Building,
Bellingham, Wash.

NOTEBOOK-POSTER CONTEST IN INDIANA

Indiana's poster contest includes a notebook contest. Realizing the need for teaching aids to be used in the schools, it was decided to require a notebook covering some dental health project, or unit, developed by individual pupils or by groups of pupils. The suggestion was made that the notebook-poster contest might be either a room or a school project. One group could develop the notebook and another the poster. It is hoped that material for developing either reference material or outlines for projects, or units, for teaching dental health in the schools can be built around the notebooks.

The Indiana State Dental Association is offering prizes amounting to a total of $100 for winners in the state contest. These prizes are in addition to those offered in local communities.

Mary H. Westfall, *Dental Health Educator,*
Bureau of Maternal and Child Health,
Indiana State Board of Health,
Indianapolis, Ind.

DENTAL ECONOMICS

INCIDENCE OF DENTAL DEFECTS IN ADULTS

FOR the benefit of those interested in the incidence of dental caries among adults the following material has been compiled.* Dentists and dental societies having additional data on this subject are invited to send them to the American Dental Association Committee on Economics, 212 E. Superior St., Chicago, Ill.

1. Restorations and missing teeth accounted for 84 per cent of the total number of defects noted.

2. Pyorrhea made up 0.3 per cent of abnormal conditions.

3. The percentage occurrence was evenly divided among males and females.

4. Apparently, females took better care of the teeth since they showed a lower percentage of caries and higher percentage of restorations (fillings).

COMPILATION OF TABULAR DATA

Age	No. in Group	Average No. Defects	Percentage of Missing Teeth Restored	Percentage of Defects
Under 20	1,366	5.1	4.0	46.0
20-29	852	7.0	5.7	38.5
30-39	159	9.3	5.6	9.6
40-49	66	10.7	3.2	4.6
50-59	23	7.9	5.1	1.2
60 plus	3	9.3	0.0	0.1
	2,469	6.3	4.9	100.0

INCIDENCE OF DENTAL DEFECTS IN TWO THOUSAND FOUR HUNDRED AND SIXTY-NINE EMPLOYMENT EXAMINATIONS

C. O. Sappington, M.D., THE JOURNAL, November 1928.

These examinations were made at the Oakland Plant of Montgomery Ward and Company. "Any demonstrable change in the structure of the tooth or pericemental tissues which may be construed as being a deviation from normal" is taken as a definition of a defective dental condition. Of the group, 55.2 per cent were under 20; 89.7 under 30, with 55 per cent male and 45 per cent female.

DENTAL SURVEY OF ONE THOUSAND ADULT MALES: A STATISTICAL STUDY CORRELATED WITH PHYSICAL AND LABORATORY FINDINGS.

H. C. Cramer, D.D.S., THE JOURNAL, January 1929.

These statistics are from a fairly accurate cross-section of a working male population, studied exhaustively from both the medical and the dental standpoint. The group consisted of 341 executives and office workers, 247 skilled workers, 183 semi-skilled workers, 224 unskilled laborers and 5 unclassified em-

*By the Committee on Economics of the American Dental Association.

INCIDENCE OF CARIES IN 1,000 CASES

Age	Patients	Restorations		Caries		Extractions	
		Total	Average	Total	Average	Total	Average
20-25	129	925	8.16	676	5.2	283	2.29
25-30	225	1,660	7.38	1,021	4.53	636	2.83
30-35	183	1,423	7.7	676	3.7	646	3.53
35-40	167	1,261	7.55	583	3.49	686	4.1
40-45	99	808	8.1	254	2.57	482	4.86
45-50	84	533	6.3	189	2.25	571	6.8
50-55	48	262	5.4	68	1.41	349	7.2
55-60	25	157	6.2	78	3.12	192	7.6
60 plus	30	88	2.9	60	2.	506	16.9
	1,000	7,117	7.11	3,600	3.6	4,351	4.35

ployes. No attempt was made to separate the classes and no observation in this respect worthy of note was made, except that, as the economic status declined, unsanitary dental conditions and focal infection increased, until the unskilled laborer was reached. He had resorted to extraction as soon as he felt discomfort from his teeth.

We find in the first half of the third decade, the highest average of carious teeth (5.2 for each mouth) and the highest average of restored carious areas (8.16 for each mouth). From this age group through the succeeding half decades, active caries gradually but steadily declines, save for a slight increase in the age group of 55 years. If we consider carious, retored and extracted teeth as evidence of caries, any combination of these data gives a result similar to that noted for active caries. These observations, therefore, do not conform to the generally accepted age periods of susceptibility to caries.

DENTAL INFECTION AND SYSTEMIC DISEASE

John Arnett, M.D., and LeRoy Ennis, D.D.S., AM. J. M. SC., June 1933.

Material for this study is based upon examination of 833 students at Drexel Institute, Philadelphia. They represent a well-to-do but not wealthy class. Examination was made by a competent dental student or a graduate dentist and a roentgen-ray film made of every tooth and edentulous space.

TABLE 1.—FREQUENCY OF CARIES SHOWN BY COMBINING CLINICAL AND ROENTGEN-RAY FINDINGS

Number of students examined	833
Number of students showing caries	733
Per cent showing caries	83
Approximate number of teeth examined	27,398
Number of teeth with caries	2,797
Per cent of teeth showing caries	10.3
Average number of carious teeth per person	3.2

TABLE 2.—OCCURRENCE OF DENTAL CARIES PER STUDENT

		Per Cent
Number of carious teeth	150	17.0
Caries in one tooth	131	14.9
2	157	17.9
3	121	13.7
4	98	11.1
Caries in five teeth	71	8.0
6	48	5.4
7	39	4.4
8	25	2.8
9	11	1.2
10	2	0.2
11	13	1.5
12	9	1.1
13	4	0.4
14	2	0.2
15	1	0.1
16	1	0.1

HEALTH DENTISTRY FOR THE COMMUNITY

Michael M. Davis, University of Chicago Press, 1935.

Practically 100 per cent of the adult population is affected by some form of oral disease.

According to the Committee on the Costs of Medical Care, not more than 25 per cent of the population receive systematic dental care, and at a per capita annual expenditure of $8.90.

Seventy-five per cent receive little or no dental care as evidenced by the fact that, in this section, the per capita allowance is $2.00 a year for dental care.

In New York City, less than 5 per cent of the 75 per cent without adequate care receive aid through clinics. Thus, 4,939,697 in New York City alone do not have adequate care.

An examination was made of the charts of 1,000 patients registered for dental care in the Clinic of the State Temporary Emergency Relief Administration. These were people who represented the white collar class, self-supporting in normal times and employed during the depression on work-relief projects. The average age was 31 years 5 months, the range being from 11 to 78 and the greatest number in one group occurring in the 25-29 age group.

The average individual had, in round numbers, four decayed teeth containing five carious cavities. Six teeth had been previously extracted and he looks forward to the immediate extraction of one more. Of the six previously extracted, two were replaced and four are missing.

Thus, eleven are involved in disease and 28 per cent are decayed, missing without replacement or must now be extracted. This represents the present toll and takes no account of previous fillings or replacements.

Only 9 per cent have all teeth present and none to be extracted.

In the 25-29 group, 89 per cent have six cavities of decay in nine teeth; 84 have lost four teeth and had one replaced, and 37 must now lose two additional teeth.

There are the greatest number of unreplaced teeth in the 65-70 group with an average of ten unreplaced teeth.

While 89 per cent have five decayed teeth, the range is from 100 per cent in the 10-14 group to 0 in the 70 plus group and the departure from average is too irregular to interpret. The conclusion is that decay is active throughout life while teeth are retained, and the extent of its incidence cannot be predicted where regular dental care from early childhood has been neglected.

CHICAGO DENTAL SOCIETY INDUSTRIAL SERVICE

Analysis of treatments and restorations indicated for 2,720 employes indicates that the average employe has two cavities; 0.9 teeth require extraction; 5.8 teeth have infection in the pulp or abscesses at the root ends, and 0.5 root fragments, impactions, etc.; total, 8.2.

Eighty-two need to have one or more teeth restored by bridgework or partial plates and 12 per cent need full upper and lower dentures.

A FOUR YEAR STUDY OF STUDENT DENTAL HEALTH SERVICE.

L. G. Welty, D.D.S., The Journal, July 1937.

This report is limited to twenty-six dental students examined in the period 1931-1935 and ranging in ages from 18 to 27 years. A class was examined each year. In 1931, there was an average of 4.7 carious teeth per student; 1932, 6.4; 1933, 7.3, and 1934, 8.2.

The necessary dental work was not completed because of lack of funds and time. The care, or hygiene, of the students was poor in view of the fact that they were dental students about to graduate and practice their profession.

A REPORT ON DENTAL CARIES IN 10,445 UNIVERSITY STUDENTS

P. J. Brekhus, D.D.S., THE JOURNAL, July 1931.

Of the 106,364 affected teeth, 8,958 had been extracted, 13,674 showed active caries and 83,732 contained fillings.

TABLE 1.—PERCENTAGE OF PERFECT MOUTHS

Year	1928	1929	1930
Male	4.70	2.55	1.58
Female	1.80	0.81	1.28

TABLE 2.—EXAMINATION DATA

Year	Number Examined	Number of Affected Teeth (Not Including Third Molars)
1928	3,346	34,384
1929	3,388	33,697
1930	3,711	38,283
Total	10,445	106,364

This gives an average per person of slightly more than ten teeth affected by caries and of less than one tooth that had been extracted.

A COURSE OF STUDY IN DENTISTRY

An examination of 12,753 employes in the Home Office of the Metropolitan Life Insurance Company of New York was made, the group being largely composed of office workers.

Thus it is apparent that only 50 per cent of the teeth of the persons constituting the age group 20-24 years were perfect and almost 11 per cent were lost. In the 40-44 group, one-third of the teeth had been lost and only a slightly higher proportion of the teeth were perfect. Almost half of the teeth were missing in the 55-59 group. The persons included in this investigation retained their teeth longer than did the patients of the Dental Clinic of the University of Minneapolis.

PERCENTAGE OF TEETH THAT WERE PERFECT AND OF TEETH MISSING

Age	Number of Persons	Percentage Perfect Teeth	Percentage Missing Teeth
16-19	4,343	56.7	8.2
20-24	4,427	49.7	10.7
25-29	1,301	44.7	15.2
30-34	757	39.4	20.0
34-39	591	38.7	26.4
40-44	432	35.0	33.4
45-49	385	33.5	38.3
50-54	250	32.9	41.5
55-59	159	27.3	48.3
60-64	65	——	——
65 plus	53	——	——

RELATION OF DENTAL CARIES TO DISEASE, MENSTRUAL EXPERIENCE AND PHYSICAL MEASUREMENTS OF YOUNG WOMEN

Ruby L. Cunningham, M.D., J. D. Res., December 1934.

Figures are given showing the incidence of dental caries in 11,117 women. (See Table 1.—Examination Data.) Every student entering the University of California is given a complete physical examination, which includes a dental examination made by a dentist. Record cards of 11,117 women from 15 to 19 years of age were available for this study. The study is

TABLE 1.—EXAMINATION DATA

Number of Damaged Teeth	0*	0-4	5-9	10-14	15-19	20	Total
Per Cent	3.4	18.9	38.5	28.8	11.7	1.8	
Number of Students	381	2,102	4,291	3,211	1,311	202	11,117

*Also included in 0-4 damaged teeth (next column).

based upon the condition of twenty-eight teeth because in many cases the third molars had not erupted. The term "damaged teeth" refers to teeth with cavities, fillings or crowns. A tooth with one filling or more is counted as a damaged tooth. In 2,562 of the 11,117 students, one or more of the twenty-eight teeth were missing. Failure of the normal number of teeth to develop and erupt and the extraction of sound teeth to correct crowding or malalinement accounted for a number of these. The larger number, undoubtedly, were extracted because of decay or its sequelae.

DENTAL REQUIREMENTS FOR ADMISSION TO THE NAVAL SERVICE*

No recruit shall be accepted unless he has at least twenty vital serviceable teeth and of these not less than four opposed incisors, of which two are directly opposed on each side of the median line, and four opposed molars, of which two are directly opposed on each side of the dental arch. Teeth properly filled or which have been properly restored by crowns may be considered serviceable when the history and appearances clearly warrant such consideration.

Examination Standards.—(a) Bicuspids shall not be classed as "molars" nor shall cuspids be classed as "incisors." (b) A carious vital tooth which can be restored satisfactorily by proper filling may be considered a serviceable tooth. A tooth is not to be considered serviceable when (1) the caries is extensive; or (2) it is involved with marked pyorrhea alveolaris; (3) it is the seat of chronic infection, or (4) it fails to enter into serviceable occlusion with the opposing teeth. (c) Abutments (natural teeth to which bridges are attached) and crowned teeth, may be counted as serviceable only when they appear to be in good condition and supported by healthy tissues.

*Submitted by E. H. Bruening, D.D.S., from report by H. D. Templeton, M.D., USN.

Dental Defects Among Navy Applicants

Total number of applicants applying at U. S. Navy recruiting station, Naval Reserve Armory, Indianapolis, Ind., during calendar year 1936 1,244
Number of applicants rejected for physical defects ..... 872 (70 per cent)
Number of applicants rejected for other reasons ..... 143 (11 per cent)
Number of applicants physically qualified ..... 228 (18 per cent)

Of the 228 whose physical condition was such that they could be accepted, 113, or 9 per cent, were given Class A physical rating. The remaining 115 were given B physical rating.

The five major disqualifying defects together with the number of each were as follows: defective teeth, 137; abnormalities of teeth, 123; errors of refraction, 118; defection, physical development, 112; flat feet, 67; total, 557.

Defective teeth, 131, and abnormalities of the teeth, 123, account for 254, or 29.1 per cent, of the total physical rejections, 872.

The report shows that in addition to the 254 applicants who were rejected primarily because of bad dental conditions, 178 of the other men on the rejected list had very marked dental conditions which could be considered a contributing factor in their rejection.

Adding the 178, whose dental conditions contributed to their failure to pass the examination, to the 254 already noted gives a total of 432, or at least 50 per cent of the 872 disqualified who had serious dental defects.

UNION OIL COMPANY OF CALIFORNIA QUESTIONNAIRE, SENT TO ALL EMPLOYES

A grand total of 5,378 answers were received. They may be summarized as follows:

With a family dentist: 3,003.

Without a family dentist: 2,375.

When last to the dentist: Six months, 39 per cent; one year, 28 per cent; year 1934, 12 per cent; year 1933, 9 per cent;

year 1932, 4 per cent; year 1931, 7 per cent. Dentures needed: Southern, 55; Central, 13; Northern, 18; Marine, Hawaii, 1.

Partial dentures needed: Southern 48; Central, 11; Northern, 25.

Having two dentures now: Southern, 129; Central, 42; Northern, 40; Marine, 2.

Having one denture now: Southern, 19; Central, 16; Northern, 25; Marine, 1.

Trench mouth: 206.

Trench mouth in family: 27.

Average spent for dentistry: To 29 years, $15.79; 30 to 39 years, $11.78; 40 to 49 years, $30.60; 50 to 59 years, $9.50; 60 and over, $5.00.

Needing prophylactic treatment: 1,084.

Prophylactic treatment previously: 75 per cent (approximately).

Those needing immediate dental services: 15 per cent estimated: 10 per cent reported bad; 4.5 fair, and 0.5 good.

Those needing medical and dental care or examination, 2 per cent.

Those having teeth cleaned twice a year, 3 per cent.

Employes now having two dentures, 5 per cent.

Employes now having one denture, 2 per cent.

Employes needing dentures, 2 per cent.

Employes needing partial dentures, 2 per cent.

CALIFORNIA MEDICAL-ECONOMIC SURVEY 1934-1935

In a survey sponsored by the California Medical Association and financed in part by the U. S. Government, the accompanying table (Table 35) shows the percentage distributions of persons reporting a need for dental care on the date of the family interview who had received a dental diagnosis.

The figures are based on records for 60,033 persons in 18,430 white families of known 1933 income and known size of community.

DIAGNOSIS OF EXISTING DENTAL NEEDS AS REPORTED AT DATE OF FAMILY INTERVIEW

(Summary)	All Communities	Under 5,000	5,000 to 99,999	100,000 to 999,999	1,000,000 and over
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
All incomes	63.8	58.6	64.3	69.1	63.6
Under $3,000	62.5	57.5	63.0	67.6	62.5
Over 3,000	83.6	85.7	81.1	91.0	79.2
Under $ 499	55.7	60.1	48.1	59.3	61.2
$ 500 to 999	56.1	46.8	61.4	62.3	53.0
1,000 to 1,199	63.5	61.0	60.7	68.1	67.2
1,200 to 1,499	67.7	62.3	71.1	72.8	62.5
1,500 to 1,999	71.2	65.4	71.0	79.7	68.4
2,000 to 2,999	75.8	72.5	78.9	71.7	76.4
3,000 to 4,999	81.5	83.0	77.6	90.0	79.1
5,000 to 9,999	88.9	100.0	87.5	100.0	76.0
10,000 and over	84.6	100.0	88.9	33.3	100.0

THE NEED FOR A NATIONAL HEALTH PROGRAM

DURING the last week of February 1938, a report was sent to President Roosevelt by Miss Josephine Roche, chairman of the Federal Interdepartmental Committee to Coordinate Health and Welfare Activities. The report, "The Need for a National Health Program," states that the committee was charged with the duty of "assessing carefully the state of the nation's health, to relate what is being done against what can be done, to search out and define needs which are not being met through current practices, and to outline proposals through which the national health may be improved."

The report points out that there is a need for better maternal and child health care. It also states that public health services should be made more comprehensive in respect to the following conditions: tuberculosis, venereal diseases, pneumonia, malaria, chronic diseases of middle and old age, cancer, diabetes, diseases of the heart, blood vessels and kidneys, arthritis and rheumatoid diseases and mental diseases.

Lack of sufficient dental care is mentioned and illustrated by quotation of figures from a "nation wide survey" in which it was found that for every thousand children entering school, there were approximately 1,300 defects that needed dental attention.

The report draws the conclusion that inability to pay for care is the most important reason for the lack of "adequate" care for many people.

The committee recommended that appropriate arrangements to minimize the impact of these costs on individual families be made. "To what extent the result shall be attained through more extensive use of tax support and to what extent through social insurance, or through a combination of both, is not at issue. Each procedure is applicable to parts of the problem, and each may be more appropriate than the other for particular groups in the population and for particular areas."

In the matter of personnel, the committee reported that the supply of physicians and nurses is adequate, but the distribution is poor. The supply of public health nurses was considered much too small, if satisfactory maternal and child health service is to be rendered.

The committee reported that there were about 71,000 dentists in the United States, or an average of fifty-eight per hundred thousand of the population. "Estimates of the needs for adequate dental care for all our population indicate that the number of dentists could be doubled without reaching a figure in excess of the true need. As in the case of physicians and nurses, the number of dentists available is particularly inadequate in rural localities, small cities and other areas where income is low. Having regard to the enormous accumulated neglect in dental care among adults, there is a tendency to especially direct such funds as are available for dental care toward preventive and other dentistry among children."

The number and location of hospitals was also considered inadequate by the committee, with a present deficiency of 400,000 beds and an estimated future need for 250,000 more beds.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Obtaining Seal in Class II Inlays—One concern in the making of Class II inlays is to obtain a proper seal along the gingival or step portion of the cavity. A piece of gold foil of the proper width placed on the step at the time the inlay is cemented will fill in any discrepancy which may have occurred in the casting and will not prevent the inlay from being seated properly when tapped into place. The excess gold foil may be removed with files and strips.—*Jerry C. Adams, Southwest City, Mo.*

Full Dentures—After fifty years of the making of full dentures (the first in 1887) and the careful consideration of each and every method published during these years, with particular reference to securing "adaptation," "fit," "retention," "suction" or whatever term is chosen for polite society, it would seem that we are not far from where we first began; that is, the desired quality mentioned is best obtained by getting an impression from a distorted mouth; which is farther changed before running the model; which in turn is modified before casting or pressing the plate; which in turn is also modified more or less before we have that which pleases and sells.

To put it another way: The denture is modified after being pressed on a model that has been modified after being cast in a modified impression that has been taken from a mouth that has been much distorted from the normal at rest. Much of the distortion has been brought about by pushing, jamming or pulling the compressible and mobile tissues from their position of rest.

In all this turmoil, there seem to be two schools of thought: one tries to accomplish the end sought by mechanical force; the other employs the arts of the sculptor, the artist.

The artist long ago succeeded in giving a degree of mouth service in full dentures which has not yet been excelled. However, the two schools of "full denture thought" are agreed on one point; i.e., they both rely on the saliva to assist in valve seal.—*W. Clyde Davis, Lincoln, Nebr.*

Polishing Inlays—To polish inlays made by any method, a little plaster can be mixed to a thick consistency and the inlay embedded with the surface to be polished up. When the plaster is sufficiently set, all excess material is trimmed away and all margins freed. In this manner, a handle, or disk as it were, is afforded for the inlay. The margins, even the finest, are never curled under. When the inlay is finally removed from its bed, the cavity portion is clean. In this way, the hand and fingers are protected from the intense heat generated in polishing the metal.—*J. Sommer, New York City.*

Substitute Bridge—When an anterior bridge is to be made, the patient can be

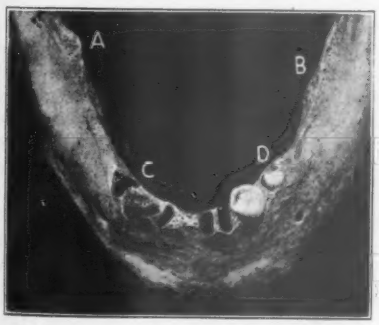
supplied with a temporary substitute by means of baseplate guttapercha and porcelain facings. A block of guttapercha is formed to fit the space. The ends are warmed and fitted around the abutment teeth so that it is held firmly. The most suitable porcelain teeth available, either vulcanite teeth or Steele's facings, are ground thin. The front of the guttapercha block is softened with a heated instrument and the facings are pressed to place. This bridge, if properly made, is fairly good looking. It can be made in a few minutes and can be taken out and put back as often as necessary. The cost is slight and it is far better to use it than to let the patient go without a bridge—*H. F. Stevenson, New York City.*

Substitute for Cocoa Butter—If cocoa butter has been used on a celluloid strip, it is a waste of time to paint the silicate filling with varnish, because varnish will not stick to the oily surface. If, instead, a little yellow bite wax or white wax, or even a bit of paraffin is melted in a procaine dissolving cup, and a small applicator is made of a toothpick and a wisp of cotton and dipped into the melted wax, the silicate can be painted very easily, and the varnish will stay on until the next toothbrushing.—*L. Wack, Bronx, N. Y.*

MISCELLANY

Identification of Skeleton Sought Through Dental Profession

December 8, 1937, two hunters going through a wooded thicket discovered the remains of a white man. Owing to the advanced state of decomposition, all that remained was the skeleton and a few personal items found in the remnants of his clothing, all of which were entirely devoid of identifying data.



Physical elements surrounding the case make it conclusive that death ensued about two years previous to discovery, from strangulation by hanging.

All efforts to identify the remains have to date proved negative.

As will be noted from the accompanying photographs, this man had had considerable dental treatment. Examination by competent dental authorities has established that this work was performed about fifteen years ago.

Any dentist or dental mechanic who recognizes the work performed is requested to wire the undersigned, furnishing any information that will tend to establish the identity of the deceased.

Harold King, Commanding Officer,
Detective Division, Police Department,
Mineola, N. Y.

DEATHS

Alper, Jacob J., Brooklyn, N. Y.; New York University College of Dentistry, 1911; died February 6; aged 49.

Barackman, Harry E., Highland Park, Ill.; Chicago College of Dental Surgery, 1919; died February 27; aged 60.

Bedell, Walter H., Poughkeepsie, N. Y.; New York University College of Dentistry, 1888; died December 23; aged 72.

Brunson, John Franklin, Meridian, Miss.; Atlanta Southern Dental College, 1900; died August 28; aged 68. Dr. Brunson revised and helped to rewrite the constitution and bylaws of the Mississippi Dental Association, and served it both as secretary and as president. He held the same positions at one time with the Meridian Dental Association, and at the time of his death was president of the board of dental examiners of Mississippi.

Cavanagh, William, Portland, Ore.; North Pacific College of Oregon, 1901; died January 24; aged 62.

Cordner, Arthur B., Middletown, N. Y.; Baltimore College of Dental Surgery, 1907; died January 7; aged 59.

Fundenberg, Walter Hullihen, Pittsburgh, Pa.; Philadelphia College of Dental Surgery, 1878; died November 7. Dr. Fundenberg was a descendant of Baron Walter von der Burg, one of the early settlers of Maryland, a lieutenant colonel in Russia during the Crimean War and, during the Civil War, surgeon of the 136th and 176th Pennsylvania Regiments. Dr. Fundenberg was dean of the University of Pittsburgh Dental School. He served as president of the state board of dental examiners. He was a former president of the Pennsylvania Dental Association and was one of the founders of the Academy of Science and Arts.

Hanaford, Marvin L., Rockford, Ill.; Temple University School of Dentistry, 1874; died January 14; aged 84. Dr. Hanaford practiced dentistry for sixty-five years. He was a past president of the Illinois State Dental Society, Northern Illinois Dental Society and the Winnebago County Dental Society.

Krider, Derrick C., Brazil, Ind.; Indiana University School of Dentistry, 1915; died February 11; aged 48.

Lingo, Arthur M., Muscatine, Iowa; State University of Iowa College of Dentistry, 1902; died January 5; aged 66.

Mason, Melville A., Fort Wayne, Ind.; University of Michigan School of Dentistry, 1890; died February 2; aged 75. Dr. Mason served as secretary-treasurer and as president of the Indiana State Dental Association. He served eight years as a member of the Indiana State Board of Dental Examiners.

Mueller, A. J., Los Angeles, Calif.; State University of Iowa College of Dentistry, 1897; died December 29; aged 65.

Mullican, L. A., Indianola, Iowa; Northwestern University Dental School, 1902; died January 10.

Palmer, E. Carlton, Philadelphia, Pa.; Temple University School of Dentistry, 1882; died February 21.

Ridgway, Joseph Emerson, Glendale, Calif.; Northwestern University Dental School, 1914; died February 3; aged 54. Dr. Ridgway was a member of the faculty of Northwestern University Dental School and served as professor of prosthetic dentistry from 1919 to 1923.

Scholten, John, Cedar Rapids, Iowa; State University of Iowa College of Dentistry, 1914; died March 8. Dr. Scholten served as secretary of the Iowa State Dental Association for many years.

Taylor, E. A., Griswold, Iowa; State University of Iowa College of Dentistry, 1890; died December 5; aged 69.

Thompson, John W., Fort Wayne, Ind.; Baltimore College of Dental Surgery, 1893; died February 15; aged 71.

Thompson, LeRoy A., Portland, Ore.; North Pacific College of Oregon, 1914; died January 15; aged 51.

Waterhouse, J. E., Sioux City, Iowa; University of Illinois College of Dentistry, 1909; died November 27; aged 59.

Wood, Thomas Wheeler, Richmond, Va.; Medical College of Virginia School of Dentistry, 1917; died October 8; aged 44.

CURRENT LITERATURE

Studies on Minute Hemolytic Streptococci

By P. H. Long and E. A. Bliss

Minute hemolytic streptococci were found in 12 per cent of 454 rhinopharynges of normal persons, but in only 4 per cent of 108 patients with chronic diseases. They were present in 15 per cent of 131 children, 55 per cent of 146 patients with rheumatic fever or its sequelae, 96 per cent of 48 patients with acute nephritis (Type A) and 40 per cent of 37 patients with Type B acute nephritis. A causal relationship with Type A nephritis is suggested.—*J. Infect. Dis.*, 62:52, 1938.

B. G. Bibby.

Hemolytic Streptococci from Throat of Normal Young Adults

By A. W. Frisch

Owing to seasonal climatic or technical differences, the figures for the occurrence of hemolytic streptococci in the throat vary greatly. This paper contributes data to this question and takes cognizance of recently established relationships between the fibrolytic and pathogenic properties of streptococci. It was found that 6.4 per cent of 621 freshman college students had group A (Lancefield) streptococci in their throats. Of 101 hemolytic strains of streptococci, 66.5 per cent caused lysis of human fibrin, but only 39.6 per cent were members of group A. Persons who had tonsils showed a higher percentage (22.2 per cent) of hemolytic cocci than did those who had had their tonsils removed (11.2 per cent). —*J. Infect. Dis.*, 62:40, 1938.

B. G. Bibby.

Relation of Anticlotting Property of Streptococcus Viridans to Dissociation and Hydrogen Ion Concentration

By Ruth Tunnicliff and Carolyn Hammond

Eight strains of *Streptococcus viridans* from tooth pulps were tested to determine their anticlotting properties as regards human blood. Smooth strains prevented clotting because of their high acid production (pH 4.4-4.8). Stabilized rough strains did not produce enough acid to inhibit fibrin coagulation. —*J. Infect. Dis.*, 62:121, 1938.

B. G. Bibby.

Experimental Investigation of New Stationary and Oscillating Hot Air Dental Sterilizers

By Urbach Heinz and Hummel Willi

The authors present a discussion of disinfection by stationary hot air sterilizers. They conclude that the main disadvantage is the extremely long period required for penetration of materials. Their examination of newer hot air dental sterilizers considers the accuracy of the thermometer in the apparatus, heat conduction in stationary and oscillating hot air using various heating methods, the influence of hot air on broaches, bacterial examinations at various temperatures and periods, the effect of the bacterial base and the practical application in sterilization. Following are the findings: The thermometers gave no clue as to the temperatures in the apparatus, showing a constantly lower temperature than those recorded on an electrical thermostat. Measurement of the heat conduction in oscillating hot air showed remarkably good adjustment to increases and decreases of temperatures which did not fluctuate because of automatic heating regulation. In stationary hot air, when bottom heating was used, a cold zone formed in the upper air layers. When top and bottom heating were employed, cold air accumulated and the maximum temperatures were in the top air layers. Temperature and sterilization time were important in maintaining sharpness of broaches. Increased heat and frequency of sterilization showed no effect. A temperature of 180-190° for from ten to fifteen minutes does not impair sharpness even if often repeated.—*Arch. f. Hyg.*, 119:1-19, October 1937.

B. G. Bibby.

Evipan Sodium in Dental Surgery

By J. Bunyan

The author has been using evipan sodium

as a dental anesthetic over a period of four years. His report includes a résumé of more than 2,000 cases. He stresses the fact that, in this series, there has been no necessity for the administration of cardiac stimulants, nor any evidence of pulmonary complications. Postoperative nausea and vertigo have been a rarity, and the degree of hemostasis is better than with any other anesthetic. Because of the results so far obtained and the pleasant and rapid mode of induction, the author is of the opinion that evipan sodium is the ideal dental anesthetic. A discussion of the evipanometer, an apparatus for the continuous injection of evipan sodium, is included.—*Brit. J. Anes.*, 15:62, January 1938.

J. VOLKER.

Pathology of the Infected Root Canal

By W. Ross

INFECTION is the usual result of death of the pulp. Because the cementum is permeable in young monkeys, a piece of arsenic placed in the pulp chamber will cause exfoliation. In human beings, the infection occurs chiefly at the apical third, poisons and bacteria passing out through the foramen and accessary canals. Leukocytes permeate the area and resorption of the root end is uncommon. Organisms responsible for the infection may gain access to the root end in two ways: by the pressure of impacted food during chewing and by a natural slow growth of a relatively few in the area. To the first type of infection, there is usually an acute reaction; to the second, a subacute type. In the subacute type, the surrounding tissue has had time to build up a resistance. The bone is slightly resorbed as a result, and no pus accumulates. Since organisms cannot be attacked by leukocytes while in the root canal, the infection persists. The author then advocates apicoectomy.

It has been shown that a dye will penetrate from the gingival margin along the lymphatics of the periodontal membrane to the apex of the tooth and into the pulp. If the pulp is dead, it may become infected from the gingival tissue in this way. The treatment of infected teeth, therefore, must go hand in hand with the treatment of infected gums if results are to be successful.—*D. J. Australia*, 10:61, 1938.

L. H. GARRISON.

Prevention of Rickets by Administration of Fat

By E. MCDOUGAL

SEVEN groups of five rats each were fed a diet 1 part basic to 3 parts flour and starch. Thirty-three cases of rickets developed. In parallel experiments in which 11 per cent of lard or olive oil was added to these diets, only doubtful or slight rickets developed in five cases out of thirty. The rickets was diagnosed by roentgenograms and by Dyer's line test. The author believes that fat aids in the absorption of calcium by the intestine.—*Biochem. J.*, 32:194, 1938.

MARTIN DEAKINS.

Remarks on the Terminations of Nerves in Human Teeth

By O. W. TIEGE

IN a series of experiments on decalcified human teeth, using the Bielschowsky's method of staining, the author was able to demonstrate delicate nerve fibers in great numbers passing through the layer of odontoblastic cells, and entering the very narrow zone of predentin. In this zone, the nerves branch among the Tomes' fibers, except in the crown portion, where large coarse ones run in association with the fibers. Endings similar to the *butons terminoux* of the central nervous system were observed.

In some cases, the nerves pass through the subdentinal zone to the orifices of the dentinal tubules, but they were never observed to pass into the tubules.

The author concludes that the anatomic arrangement is such as would be expected from Tomes' theory that the odontoblastic fibers conduct stimuli from the dentin to the pulp.—*J. Anat.*, 72:234, January 1938.

WILLIAM E. HAHN.

Adamantinoma of Tibia

By D. REHBOCK and C. BARBER

THE adamantinoma, an epithelial tumor long recognized as arising in the jaw and in the hypophysis cerebri, is known also to occur in a third location; namely, the tibia. An analysis of reported cases shows this type tumor to be comparatively rare. The authors list seven. The origin in the tibia is not so clearly explained as that of those arising within the jaw and hypophysis. It is assumed that it originates from fetal cell rests formed dur-

ing the intra-uterine period, with trauma promoting growth. It is also believed that the growth arises from epithelium implanted at the time of injury. Regardless of location, it tends to reproduce the essential features of the enamel organ and the characteristics are similar to those manifest in the jaw.—*J. Bone & Joint Surg.*, 20:187, January 1938.

WILLIAM E. HAHN.

Calcium

By G. WISHART

THIS paper, essentially a brief review of dental aspects of calcium metabolism, points out the confusion in the work, discusses dietary sources, the properties of calcium and its rôle in tissue metabolism, absorption of calcium and the daily requirements in normalcy and in pregnancy. Twenty-one references to pertinent literature are given. The author concludes that caries may have several etiologic factors rather than one.—*Brit. D. J.*, 64:129, 1938.

MARTIN DEAKINS.

Inhibitory Effect of Human Saliva on Growth of Tubercle Bacilli

By C. ROLLESTON

TESTS on the inhibitory effect of saliva were made with a known quantity of bovine strain of tubercle bacilli, saliva and normal saline solution. The medium used for the tests demonstrated few colonies in the saliva tubes, with one exception, that being the saliva taken from a patient who, a few years before, had had an infraclavicular lung infiltration plus a positive sputum test. The tubes containing the saline solution all contained large colonies. Thus, under certain circumstances, saliva inhibits the growth of bacteria, and possibly the immunity or antibacterial factor is important in the prevention of tuberculosis.—*Tubercle*, 19:24, 1927; abstr. *Brit. J. Child. Dis.*, 34:297, October-December 1937.

B. J. FREY.

Value of Mapharsen in Treatment of Congenital Syphilis

By E. MORGAN

IT is important when treating children to select a drug to which there is as little systemic reaction as possible. The use of mapharsen, an arsenical compound (meta-amino-parahydroxyphenyl arsine oxide), is not a recent discovery. It was evolved by Ehrlich and his associates, and it is thought to be the active principle of arsphenamine. The drug is safe and easy to administer. Reactions following its use are mild and can be almost completely eliminated by care in adjusting the dosage. An analysis of forty cases treated over a period of sixteen months strongly suggests that the drug when used as a serum is a more powerful agent in effecting cure than is any other arsenical compound previously used in the clinic.—*Canadian M. A. J.*, 38:53, January 1938.

EDWARD HAMPP.

Surgical Treatment of Facial Injuries

By F. RISCHON

THE author deals with injuries of the face, including the supporting bony structures. All displaced bones should be replaced at the earliest possible opportunity. This may mean neglecting the contusions until the underlying bony structures are elevated to their normal contour. Several valuable technics are ventured for reducing fractures of both the maxillae and the mandible. After the fractured bones are fixed in position, attention is turned to lacerations. All foreign bodies should be removed with a hand brush, and green soap and peroxide, before any attempt is made to approximate the edges of the wound. This procedure is carried out under a general anesthesia.—*Canadian M. A. J.*, 38:33, January 1938.

EDWARD HAMPP.

Superficial Intra-Oral Use of Roentgen Rays

By L. HOLLANDER and J. M. SHELTON

THE Chaoul contact therapy unit with a "shock proof" tube and a water-cooled jacket was used by the authors for intra-oral treatment. The rays are filtered through water and a thin nickel window. The stand and tube are adjustable and the treatment is administered to the patient in an ordinary dental chair. Fourteen patients with carcinoma of the tongue were treated (two early and twelve advanced cases). The local lesions disappeared in four, improved markedly in six and showed no improvement in one. In three instances, the patient died. In carcinoma of the buccal mucous membranes (one early, thirteen advanced cases), the lesions disappeared in six, improved in five and showed no im-

provement in two cases. In one instance, the patient died. Of three advanced and two early carcinomas of the pharyngeal walls and tonsils, all the lesions disappeared locally. Three lesions of advanced carcinoma of the hard and soft palate disappeared, as did two early carcinomas of the alveolar ridge. Two intra-oral sarcomas disappeared and one improved, and in one case the patient died. In three cases of leukoplakia and two of lingua nigra, the lesions disappeared. The dosage used in this form of contact roentgen therapy was usually twenty consecutive daily doses of 540 roentgen units. The advantages are ease of treatment, relatively low cost, availability, good results and flexibility of the apparatus. Difficulty in visualizing the lesion with the apparatus in the mouth is a disadvantage.—*Arch. Derm. & Syph.*, 37:279, February 1938.

HAMILTON ROBINSON.

Osteomyelitis of the Mandible

By T. E. CARMODY

THE mandible is a unique bone in that it is exposed to injuries and infections from all sides. Infection may enter it through a dental pulp, tooth socket or vascular channels or along nerve sheaths. The causes of osteomyelitis of the mandible may be of dental origin, even from roentgenologically negative teeth, or may be of traumatic origin. Complications may include general infection, local spread of infection, meningitis (rare), cebral abscesses, erysipelas or tetanus. Since the dentist is often first consulted by the patient with an osteomyelitis about the jaws, he should be thoroughly familiar with its diagnosis. Treatment essentially consists of establishment and maintenance of drainage. The author prefers external drainage at the lowest point, removal of abscessed or loose teeth, allowance of time for sequestration, removal of sequestra and attention to healing. "Because dental caries is such an important factor in the production of osteomyelitis, the physician must add the knowledge of its importance to his mental awareness in examining the oral cavity. . . . The dentist is no longer satisfied with mere inspection of the teeth for caries and gingivitis, or even with the added information afforded by a roentgenological examination of the entire mouth. He now seeks additional information as to the existence of infection around the pyorrheal tooth."—*Arch. Otolaryng.*, 27:35, January 1938.

HAMILTON ROBINSON.

Life Expectancy and Incidence of Malignant Disease. II Carcinoma of the Lip, Oral Cavity, Larynx and Antrum.

By C. E. WELCH and I. T. NATHANSON

THE median life expectancy in untreated intra-oral carcinoma was found to be ten months; in treated cases, seventeen (males) to twenty-one (females) months. Median life expectancy computed for various intra-oral sites were: lip, sixty-six months; buccal mucous membranes, twenty-four months, maxillary alveolar process, twenty months, mandibular alveolar process, eighteen months; palate, eighteen months; tongue, seventeen months, and floor of mouth, seventeen months. Carcinoma of the tongue and lip were observed to be more malignant in the young.—*Am. J. Cancer*, 31:238, 1937.

HAMILTON ROBINSON.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

American Dental Association, St. Louis, Mo., October 24-28.

American Academy of Restorative Dentistry, St. Louis, Mo., October 22-23.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

American Society of Orthodontists, Los Angeles, Calif., July 11-14.

Great Lakes Association of Orthodontists, Cleveland, Ohio, November 7-8.

North Atlantic Orthodontic Society, New York City, April 27.

District of Columbia Dental Society, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

Cleveland Dental Society, Cleveland, Ohio, April 4-5.

American Dental Society of Europe, Stockholm, August 1-3.

Baltimore College of Dental Surgery Alumni, Baltimore, Md., June 1-4.

New York College of Dentistry Class of 1923, New York City, April 7.

Temple University Dental School Alumni, Philadelphia, Pa., May 25-27.

Washington University Dental Alumni Association, St. Louis, Mo., April 20.

Montreal Dental Club Clinic, at Montreal, Canada, October 12-14.

Association of French-Speaking Dentists of North America, Montreal, Canada, June 2-5.

ARPA Internationale, Prague, Czechoslovakia, August 26-28.

American Dental Hygienists' Association, St. Louis, Mo., October 24-28.

American Dental Assistants Association, St. Louis, Mo., October 24-28.

Dental Hygienists Association of the State of New York, Syracuse, May 11-13.

STATE SOCIETIES

April

Alabama, at Birmingham (11-13)
Arizona, at Tucson (23-24)
California, at Stockton (4-6)
Kansas, at Wichita (24-27)
Kentucky, at Louisville (4-6)
Louisiana, at Alexandria (28-30)
Massachusetts, at Boston (25-28)
Michigan, at Detroit (18-20)
Mississippi, at Meridian (25-27)
New Jersey, at Atlantic City (20-22)
Oklahoma, at Tulsa (17-20)
Texas, at San Antonio (25-28)
Virginia, at Richmond (4-6)
Wisconsin, at Milwaukee (25-28)

May

Arkansas, at Little Rock (16-18)
Connecticut, at New Haven (4-6)
Georgia, at Macon (16-18)
Illinois, at Peoria (10-12)
Indiana, at Indianapolis (16-18)
Iowa, at Davenport (3-5)
Maryland, at Baltimore (2-3)
Missouri, at Columbia (8-9)
Montana, at Helena (5-7)
Nebraska, at Lincoln (16)
New York, at Syracuse (10-13)
North Carolina, at Winston-Salem (2-4)
North Dakota, at Minot (16-18)
Pennsylvania, at Philadelphia (3-5)
South Dakota, at Watertown (23-24)
Tennessee, at Chattanooga (9-12)
Vermont, at Rutland (18-19)
West Virginia, at Wheeling (16-18)

June

Colorado, at Estes Park (20-22)
Maine, at Portland (27-28)
Nevada, at Reno (4)
New Hampshire, at North Conway (6-7)

New Mexico, at Carlsbad
South Carolina, at Columbia (13-14)

November

Ohio, at Cleveland
Florida, at Jacksonville (10-12)

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 20. James A. Blue, Comer Bldg., Birmingham, Secretary.

California, at San Francisco, May 23; at Los Angeles, June 20. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Connecticut, at Hartford, June 21-25. Almond J. Cutting, Southington, Recorder.

Florida, at Jacksonville, June 20. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Iowa, at Iowa City, May 30-June 3. Hardy F. Pool, Mason City, Secretary.

Kentucky, June 14-17. Robert L. Sprau, 970 Baxter Ave., Louisville, Secretary.

Louisiana, at New Orleans, June 14-18. Joseph L. Webre, Audubon Bldg., New Orleans, Secretary.

Maine, at Augusta, June 23-25. Fred B. Wheaton, 319 Main St., Biddeford, Secretary.

Minnesota, at Minneapolis, June 17-23. Paul Hagen, Crookston, Secretary.

Mississippi, at Jackson, June 21. A. B. Kelly, Yazoo City, Secretary.

Montana, at Helena, July 11. Leonard A. Jenkin, 401 Ford Bldg., Great Falls, Secretary.

New Jersey, June 27-July 2. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

North Carolina, at Raleigh, June 27. Wilbert Jackson, Rich Bldg., Clinton, Secretary.

North Dakota, at Fargo, July 11-14. W. E. Cole, Bismarck, Secretary.

Ohio, at Columbus, June 27. Morton H. Jones, 1553½ North Fourth St., Columbus, Secretary.

South Carolina, at Columbia, June 9-11. P. B. Hair, Spartanburg, Secretary.

Tennessee, at Memphis, June 13. B. C. Gallimore, Commercial Bank Bldg., McKenzie, Secretary.

Texas, at Houston, June 21-25. B. Carl Holder, Nixon Bldg., Corpus Christi, Secretary.

West Virginia, at Charleston, June 27. Henry C. Hill, Dominion Bldg., Charleston, Secretary.

Wisconsin, at Milwaukee, June 20-24. S. F. Donovan, Tomah, Secretary.

NATIONAL BOARD OF DENTAL EXAMINERS

The National Board of Dental Examiners will hold a session for the examination of candidates in Parts I and II, May 6 and 7, in such cities as five or more candidates request. For information and application blanks, address

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

The South Carolina State Dental Association will hold its next annual meeting June 13-14, at Columbia.

P. B. HAIR, *Secretary,*
Spartanburg.

BOARD OF DENTAL EXAMINERS OF ALABAMA

The Board of Dental Examiners of Alabama will conduct its next annual dental examinations in Birmingham, commencing at 8:30 a. m., June 20. All credentials must be in the office of the secretary at least two weeks before the date of commencement of the examinations. Address all communications to

JAMES A. BLUE, *Secretary,*
1016 Comer Bldg.,
Birmingham.

CONNECTICUT DENTAL COMMISSION

The Connecticut Dental Commission will meet in Hartford, June 21-25, for the examination of applicants for license to practice dentistry and dental hygiene, and to transact any other business proper to come before it. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

ALMOND J. CUTTING, *Recorder,*
Southington.

LOUISIANA STATE BOARD OF DENTISTRY

The next examination of the Louisiana State Board of Dentistry for license to practice dentistry and dental hygiene will be held in New Orleans, June 14-18. All credentials

must be in the office of the secretary at least twenty days prior to the examination. Address all communications to

JOSEPH L. WEBRE, *Secretary,*
740 Audubon Bldg.,
New Orleans.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Minnesota State Board of Dental Examiners will be held at the School of Dentistry, University of Minnesota, Minneapolis, June 17-23, for granting licenses to practice dentistry and dental hygiene in the state. All applications must be in the hands of the secretary at least ten days previous to the opening of the examination. Address all communications regarding particulars to

PAUL HAGEN, *Secretary,*
Crookston.

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

The Mississippi State Board of Dental Examiners will hold its annual meeting for the examination of applicants to practice dentistry and dental hygiene in the State Capitol Building, Jackson, June 21. Application blanks may be had from the secretary on request. Applications, together with fee of $25, must be in the hands of the secretary not later than June 1.

A. B. KELLY, *Secretary,*
Yazoo City.

SOUTH CAROLINA BOARD OF DENTAL EXAMINERS

The South Carolina Board of Dental Examiners will hold the next examination in Columbia, June 9-11.

P. B. HAIR, *Secretary,*
Spartanburg.

TEXAS BOARD OF DENTAL EXAMINERS

The Texas Board of Dental Examiners will hold its next examination June 21-25, at the Rice Hotel in Houston. Applications must be filed at least ten days prior to date of examination. For further information, address

B. CARL HOLDER, *Secretary,*
1009 Nixon Bldg.,
Corpus Christi.

WEST VIRGINIA STATE DENTAL BOARD

The next examination of the West Virginia State Dental Board will be held at the Capitol Building, Charleston, beginning June 27. All applications must be in the hands of the secretary thirty days before the date of the examinations. For further information, address

HENRY C. HILL, *Secretary,*
Dominion Bldg.,
Charleston.

WISCONSIN DENTAL HYGIENISTS' ASSOCIATION

A meeting of the Wisconsin Dental Hygienists' Association will be held in conjunction with a meeting of the Wisconsin State Dental Association, at the Schroeder Hotel, Milwaukee, April 25-28.

MARY SIRIANNI, *Chairman,*
Publicity Committee,
721 N. 17th St.,
Milwaukee.

NORTH ATLANTIC ORTHODONTIC SOCIETY

The eighth semi-annual meeting of the North Atlantic Orthodontic Society will be held at the Hotel Pennsylvania, New York City, Wednesday afternoon and evening, April 27.

EDWARD A. LUSTERMAN, *Secretary,*
185 West End Ave.,
Brooklyn, N. Y.

NEW YORK UNIVERSITY COLLEGE OF DENTISTRY CLASS OF 1913

On or before June 5, the twenty-fifth anniversary of the class of 1913 of the New York University College of Dentistry will be celebrated, the exact date, place and time to be published later. For further information, address

J. R. SCHWARTZ,
1 Hanson Place,
Brooklyn, N. Y.

BALTIMORE COLLEGE OF DENTAL SURGERY

The annual alumni meeting and commencement week activities of the Baltimore College of Dental Surgery, Dental School, University of Maryland, will be held June 1-4.

GEORGE M. ANDERSON, *Chairman,*
Alumni and Commencement
Week Activities.

UNIVERSITY OF PENNSYLVANIA DENTAL ALUMNI

The Dental Alumni of the University of Pennsylvania will hold their reunion in Philadelphia, June 9-11.

VICTOR H. FRANK, *Chairman,*
Publicity Committee,
1800 Pine St.,
Philadelphia, Pa.

COLLEGE OF DENTAL AND ORAL SURGERY CLASS OF 1923

The fifth annual reunion of the Class of 1923 of the College of Dental and Oral Surgery will be held in May 1938. All members are urged to communicate with

SIDNEY E. RIESNER, *Secretary,*
136 E. 36th St.,
New York City.

WASHINGTON UNIVERSITY DENTAL ALUMNI ASSOCIATION

The seventy-second annual meeting of the Washington University Dental Alumni Association will be held April 20 at the School of Dentistry in St. Louis. Frederick W. Broderick, M.R.C.S. (Eng.), L.R.C.P. (Eng.), L.D.S. (Eng.), will speak on the medical aspects of dental diseases. He is honorary dental physician to the Royal Victoria and West Hants Hospital; honorary dental surgeon to the National Sanatorium for Diseases of the Chest; Cartwright Prizeman for the years 1926 and 1931, and member of the Royal College of Surgeons.

Dr. Broderick will remain in America about four weeks. He will give a series of sixteen lectures at the Washington University Medical Center. Dr. Broderick will feature the ultramicroscope and will show motion pictures of particles in Brownian movement in the blood. This, it is understood, will be the first time such a presentation has been made in America.

M. E. Niswonger, of Dayton, Ohio, will present a paper on the anatomic and physiologic limits of a full lower impression and will supplement his lecture with motion pictures.

JOHN ENLOE, *Chairman,*
Program Committee.

ESSEX COUNTY DENTAL SOCIETY

The Essex County Dental Society will meet for dinner at Essex House, 1048 Broad St., Newark, N. J., April 18, at 6:45. At 9 o'clock, the following essayists will be heard at the Newark Academy of Medicine, 91 Lincoln Park: C. Willard Camalier, Kenneth A. Easlick, Anna S. Starr and Stanley Nichols.

M. I. SHAMBERG MEETING

The second annual M. I. Shamberg meeting will be held April 7 at 9 p.m. in the solarium of the Bronx Hospital, Fulton Ave. at 169th St., under the auspices of the hospital dental staff. Leroy M. S. Miner will be the essayist, with Leo Winter and Abraham O. Wilensky discussers.

DAVID WURZEL,
1749 Grand Concourse,
New York City.

ASSOCIATION OF FRENCH-SPEAKING DENTISTS OF NORTH AMERICA

L'Association des Dentistes de Langue française de l'Amerique du Nord is holding its annual convention in Montreal at the Mount Royal Hotel, June 2-5. The practicing dentists of French descent or having any relation with the French-Canadian population of the Province of Quebec are requested to send their names and addresses to

EPHREM VINET, *Chairman,*
Committee on Propaganda,
362 East St. Joseph Blvd.,
Montreal, P. Q.

DENTAL HYGIENISTS ASSOCIATION OF NEW YORK STATE

The eighteenth annual meeting of the Dental Hygienists Association of the State of New York will be held May 11-13 at Hotel Onondaga, Syracuse.

FERN L. ATKINSON, *Chairman,*
Publicity Committee,
54 Urban St.,
Buffalo.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A competitive examination to select not more than twenty for appointment in the Dental Corps of the Navy will be held July 5, 1938, at the Naval Medical School, Washington, D. C., Naval Training Station, Great Lakes, Ill., and Naval Training Station, San Diego, Calif.

A candidate for appointment in the Dental Corps must be a citizen of the United States,

and must be between 21 and 32 years of age at the time of appointment, a graduate of a standard dental college, of good moral character and of unquestionable professional repute. Credentials relative to character, citizenship, date of birth and education must be submitted and approved before an applicant can be authorized to appear for examination.

Senior students in dental colleges may submit applications to appear for the examination held next after their dates of graduation. They should submit with their applications and credentials a letter from the dean of their dental school stating that they are members of the senior class and, immediately after receiving their diplomas, a letter from the dean or registrar of the dental school that they have received the degree of doctor of dental surgery or doctor of dental medicine as the case may be.

A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

AMERICAN BOARD OF ORTHODONTIA

A meeting of the American Board of Orthodontia will be held in Los Angeles, Calif., July 8. Orthodontists who desire to qualify for certificates from the board should secure the necessary application blanks from the secretary. Applications, together with any other required credentials, must be returned to the secretary at least sixty days prior to the date of examination. Applications filed at the time of the board meeting will have preliminary consideration that the applicant may be advised of the work required for his subsequent examination.

Attention is called to the following resolutions adopted by the board:

Any person desiring to make application to the board for a certificate must have been in the exclusive practice of orthodontics for a period of not less than five years or an equivalent to be determined by the board and based upon the following conditions: 1. He must be an instructor in orthodontics in a school satisfactory to the board. 2. He must be an associate in the office of an orthodontist whose standing is satisfactory to the board. 3. It is to be definitely understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontics in his own name.

For further information, address

CHARLES R. BAKER, *Secretary,*
636 Church St.,
Evanston, Ill.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING FEBRUARY 1938

February 1

No. 2,106,809, to CHARLES H. PRANGE and ERICH H. ZAHN. Swaged Denture and Method of Making the Same.

No. 2,107,181, to WILLIAM R. A. GUYTON. Denture.

February 8

No. 2,107,283, to HOWELL BOATNER. Dental Articulator.

No. 2,107,534, to HARRY P. HOUSER. Face Meter.

No. 2,107,563, to EDWARD L. CHOTT. Dispensing Cap.

No. 2,107,791, to WILLIAM HENNING. Dental Tool.

No. 2,107,966, to JUNZO TAGUCHI. Attachment for Artificial Teeth.

February 15

No. 2,108,558, to WILLIAM B. JACKMAN. Dental Instrument.

February 22

No. 2,108,953, to WALTER J. VAN ROSSEM. Flexible Package for Hydrocolloid Impression Materials.

No. 2,108,980, to NOBLE G. WILLS. Dental Model Surveyor.

No. 2,109,086, to HILAIRE P. COUSSEMENT and FLORIS CAPPETTE. Grinding Instrument for Use in Dental Work.

No. 2,109,138, to FREDERICK MAULEN. Tooth Pins for Artificial Teeth.

No. 2,109,417, to CATHERINE BOLLING ELGAN. Dental Floss Holder.

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1937-1938

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